

SD-4		When S>L: $S = \frac{1079.15}{A} + \frac{L}{2}$																			When S<L: $S = 46.454 \sqrt{\frac{L}{A}}$																			S = Sight Distance in Feet		Sheet 1 of 2	
A = Algebraic Difference of Grades in Percent	L = Length of Vertical Curve in Feet																				A = Algebraic Difference of Grades in Percent																						
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000																							
2.0	565	590	615	640	665	690	715	740	765	790	815	840	865	890	915	940	965	990	1015	1040	2.0																						
2.5	457	482	507	532	557	582	607	632	657	682	707	732	757	782	807	832	857	881	906	929	2.5																						
3.0	385	410	435	460	485	510	535	560	585	610	635	660	685	710	735	759	782	805	827	848	3.0																						
3.5	333	358	383	408	433	458	483	508	533	558	583	608	633	657	680	702	724	745	765	785	3.5																						
4.0	295	320	345	370	395	420	445	470	495	520	545	569	592	615	636	657	677	697	716	735	4.0																						
4.5	265	290	315	340	365	390	415	440	465	490	514	536	558	579	600	619	638	657	675	692	4.5																						
5.0	241	266	291	316	341	366	391	416	441	465	487	509	530	550	569	588	606	623	640	657	5.0																						
5.5	221	246	271	296	321	346	371	396	420	443	465	485	505	524	542	560	577	594	611	626	5.5																						
6.0	205	230	255	280	305	330	355	379	402	424	445	465	484	502	519	536	553	569	585	600	6.0																						
6.5	191	216	241	266	291	316	341	364	387	407	427	446	465	482	499	515	531	547	562	576	6.5																						
7.0	179	204	229	254	279	304	328	351	372	393	412	430	448	465	481	497	512	527	541	555	7.0																						
7.5	169	194	219	244	269	294	317	339	360	379	398	415	432	449	465	480	495	509	523	536	7.5																						
8.0	160	185	210	235	260	284	307	328	348	367	385	402	419	435	450	465	479	493	506	519	8.0																						
8.5	152	177	202	227	252	276	298	319	338	356	374	390	406	422	436	451	465	478	491	504	8.5																						
9.0	145	170	195	220	245	268	290	310	328	346	363	379	395	410	424	438	451	465	477	490	9.0																						
9.5	139	164	189	214	238	261	282	301	320	337	353	369	384	399	413	426	439	452	465	477	9.5																						
10.0	133	158	183	208	232	254	275	294	312	328	345	360	375	389	402	415	428	441	453	465	10.0																						
10.5	128	153	178	203	227	248	268	287	304	321	336	351	365	379	393	405	418	430	442	453	10.5																						
11.0	123	148	173	198	221	243	262	280	297	313	328	343	357	371	384	396	408	420	432	443	11.0																						
11.5	119	144	169	194	217	237	256	274	291	306	321	336	349	362	375	387	399	411	422	433	11.5																						
12.0	115	140	165	190	212	232	251	268	284	300	314	328	342	355	367	379	391	402	413	424	12.0																						
12.5	111	136	161	186	208	228	246	263	279	294	308	322	335	348	360	372	383	394	405	415	12.5																						
13.0	108	133	158	182	204	223	241	258	273	288	302	316	328	342	353	364	376	387	397	407	13.0																						
13.5	105	130	155	179	200	219	237	253	268	283	297	310	322	335	346	358	369	379	390	400	13.5																						
14.0	102	127	152	176	196	215	232	248	263	278	291	304	317	328	340	351	362	372	383	393	14.0																						
14.5	99	124	149	173	193	211	228	244	259	273	286	299	311	323	334	345	356	366	376	386	14.5																						
15.0	97	122	147	170	190	208	224	240	254	268	281	294	306	317	328	339	350	360	370	379	15.0																						
16.0	92	117	142	164	184	201	217	232	246	260	272	284	296	307	318	328	339	348	358	367	16.0																						
17.0	88	113	138	159	178	195	211	225	239	252	264	276	287	298	309	319	328	338	347	356	17.0																						
18.0	85	110	134	155	173	190	205	219	232	245	257	268	279	290	300	310	319	328	337	346	18.0																						
19.0	82	107	131	151	169	185	199	213	226	238	250	261	272	282	292	301	311	320	328	337	19.0																						
20.0	79	104	127	147	164	180	194	208	220	232	244	254	265	275	284	294	303	312	320	328	19.0																						

SIGHT DISTANCE ON VERTICAL CURVES

NEW 10/02

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 2.00 FEET

608.06

VIRGINIA DEPARTMENT OF TRANSPORTATION

A = Algebraic Difference of Grades in Percent	When S > L: $S = \frac{1079.15}{A} + \frac{L}{2}$																				When S < L: $S = 46.454\sqrt{\frac{L}{A}}$																				SD-4 Algebraic Difference of Grades in Percent
	S = Sight Distance in Feet																																								
	L = Length of Vertical Curve in Feet																																								
	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000																					
2.0	1065	1089	1114	1138	1161	1184	1207	1229	1251	1272	1293	1314	1334	1354	1374	1394	1413	1432	1451	1469	2.0																				
2.5	952	974	996	1018	1039	1059	1079	1099	1119	1138	1157	1175	1193	1211	1229	1246	1264	1281	1297	1314	2.5																				
3.0	869	890	910	929	948	967	985	1004	1021	1039	1056	1073	1089	1106	1122	1138	1154	1169	1184	1199	3.0																				
3.5	805	824	842	860	878	895	912	929	946	962	978	993	1009	1024	1039	1053	1068	1082	1096	1110	3.5																				
4.0	753	770	788	805	821	837	853	869	884	900	914	929	943	958	972	985	999	1012	1026	1039	4.0																				
4.5	710	726	743	759	774	790	805	819	834	848	862	876	890	903	916	929	942	955	967	979	4.5																				
5.0	673	689	705	720	735	749	763	777	791	805	818	831	844	857	869	881	894	906	917	929	5.0																				
5.5	642	657	672	686	700	714	728	741	754	767	780	792	805	817	829	840	852	863	875	886	5.5																				
6.0	615	629	643	657	671	684	697	710	722	735	747	759	770	782	793	805	816	827	837	848	6.0																				
6.5	590	604	618	631	644	657	669	682	694	706	717	729	740	751	762	773	784	794	805	815	6.5																				
7.0	569	582	595	608	621	633	645	657	669	680	691	702	713	724	735	745	755	765	775	785	7.0																				
7.5	550	563	575	588	600	612	623	635	646	657	668	679	689	699	710	720	730	739	749	759	7.5																				
8.0	532	545	557	569	581	592	603	615	625	636	647	657	667	677	687	697	706	716	725	735	8.0																				
8.5	516	528	540	552	563	574	585	596	607	617	627	637	647	657	667	676	685	695	704	713	8.5																				
9.0	502	514	525	536	547	558	569	579	590	600	610	619	629	638	648	657	666	675	684	692	9.0																				
9.5	488	500	511	522	533	543	554	564	574	584	593	603	612	621	630	639	648	657	666	674	9.5																				
10.0	476	487	498	509	519	530	540	550	559	569	578	588	597	606	615	623	632	640	649	657	10.0																				
10.5	465	475	486	497	507	517	527	536	546	555	564	573	582	591	600	608	617	625	633	641	10.5																				
11.0	454	465	475	485	495	505	515	524	533	542	551	560	569	577	586	594	602	611	619	626	11.0																				
11.5	444	454	465	475	484	494	503	513	522	531	539	548	556	565	573	581	589	597	605	613	11.5																				
12.0	435	445	455	465	474	484	493	502	511	519	528	536	545	553	561	569	577	585	592	600	12.0																				
12.5	426	436	446	455	465	474	483	492	500	509	517	526	534	542	550	557	565	573	580	588	12.5																				
13.0	417	427	437	446	456	465	473	482	491	499	507	515	523	531	539	547	554	562	569	576	13.0																				
13.5	410	419	429	438	447	456	465	473	481	490	498	506	514	521	529	536	544	551	558	565	13.5																				
14.0	402	412	421	430	439	448	456	465	473	481	489	497	504	512	519	527	534	541	548	555	14.0																				
14.5	395	405	414	423	431	440	448	456	465	472	480	488	496	503	510	518	525	532	539	546	14.5																				
15.0	389	398	407	415	424	432	441	449	457	465	472	480	487	495	502	509	516	523	530	536	15.0																				
16.0	376	385	394	402	411	419	427	435	442	450	457	465	472	479	486	493	500	506	513	519	16.0																				
17.0	365	374	382	390	398	406	414	422	429	436	444	451	458	465	471	478	485	491	498	504	17.0																				
18.0	355	363	371	379	387	395	402	410	417	424	431	438	445	451	458	465	471	477	484	490	18.0																				
19.0	345	353	361	369	377	384	392	399	406	413	420	426	433	439	446	452	458	465	471	477	19.0																				
20.0	337	345	352	360	367	375	382	389	396	402	409	415	422	428	435	441	447	453	459	465	20.0																				

SIGHT DISTANCE ON VERTICAL CURVES

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 2.00 FEET

NEW 10/02

SD-5		When S>L: $S = \frac{1400}{A} + \frac{L}{2}$																			When S<L: $S = 52.915 \sqrt{\frac{L}{A}}$																			S = Sight Distance in Feet		Sheet 1 of 2		A = Algebraic Difference of Grades in Percent
A = Algebraic Difference of Grades in Percent	L = Length of Vertical Curve in Feet																				A = Algebraic Difference of Grades in Percent																							
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000																								
2.0	725	750	775	800	825	850	875	900	925	950	975	1000	1025	1050	1075	1100	1125	1150	1175	1200	2.0																							
2.5	585	610	635	660	685	710	735	760	785	810	835	860	885	910	935	960	985	1010	1035	1060	2.5																							
3.0	492	517	542	567	592	617	642	667	692	717	742	767	792	817	842	867	892	917	942	966	3.0																							
3.5	425	450	475	500	525	550	575	600	625	650	675	700	725	750	775	800	825	849	872	894	3.5																							
4.0	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	748	771	794	815	837	4.0																							
4.5	336	361	386	411	436	461	486	511	536	561	586	611	636	660	683	706	727	748	769	789	4.5																							
5.0	305	330	355	380	405	430	455	480	505	530	555	580	603	626	648	669	690	710	729	748	5.0																							
5.5	280	305	330	355	380	405	430	455	480	505	529	553	575	597	618	638	658	677	695	714	5.5																							
6.0	258	283	308	333	358	383	408	433	458	483	507	529	551	572	592	611	630	648	666	683	6.0																							
6.5	240	265	290	315	340	365	390	415	440	464	487	508	529	549	568	587	605	623	640	656	6.5																							
7.0	225	250	275	300	325	350	375	400	424	447	469	490	510	529	548	566	583	600	616	632	7.0																							
7.5	212	237	262	287	312	337	362	386	410	432	453	473	493	511	529	547	563	580	596	611	7.5																							
8.0	200	225	250	275	300	325	350	374	397	418	439	458	477	495	512	529	545	561	577	592	8.0																							
8.5	190	215	240	265	290	315	340	363	385	406	426	445	463	480	497	513	529	544	559	574	8.5																							
9.0	181	206	231	256	281	306	330	353	374	394	414	432	450	467	483	499	514	529	544	558	9.0																							
9.5	172	197	222	247	272	297	321	343	364	384	403	421	438	454	470	486	501	515	529	543	9.5																							
10.0	165	190	215	240	265	290	313	335	355	374	392	410	427	443	458	473	488	502	516	529	10.0																							
10.5	158	183	208	233	258	283	306	327	346	365	383	400	416	432	447	462	476	490	503	516	10.5																							
11.0	152	177	202	227	252	276	298	319	338	357	374	391	407	422	437	451	465	479	492	505	11.0																							
11.5	147	172	197	222	247	270	292	312	331	349	366	382	398	413	427	441	455	468	481	493	11.5																							
12.0	142	167	192	217	242	265	286	306	324	342	358	374	389	404	418	432	445	458	471	483	12.0																							
12.5	137	162	187	212	237	259	280	299	317	335	351	367	382	396	410	423	436	449	461	473	12.5																							
13.0	133	158	183	208	232	254	275	294	311	328	344	359	374	388	402	415	428	440	452	464	13.0																							
13.5	129	154	179	204	228	249	269	288	306	322	338	353	367	381	394	407	420	432	444	455	13.5																							
14.0	125	150	175	200	224	245	265	283	300	316	332	346	361	374	387	400	412	424	436	447	14.0																							
14.5	122	147	172	197	220	241	260	278	295	311	326	340	354	368	381	393	405	417	428	439	14.5																							
15.0	118	143	168	193	216	237	256	273	290	306	320	335	348	361	374	386	398	410	421	432	15.0																							
16.0	113	138	163	187	209	229	247	265	281	296	310	324	337	350	362	374	386	397	408	418	16.0																							
17.0	107	132	157	181	203	222	240	257	272	287	301	314	327	340	351	363	374	385	396	406	17.0																							
18.0	103	128	153	176	197	216	233	249	265	279	292	306	318	330	342	353	364	374	384	394	18.0																							
19.0	99	124	149	172	192	210	227	243	258	271	285	297	309	321	332	343	354	364	374	384	19.0																							
20.0	95	120	145	167	187	205	221	237	251	265	277	290	302	313	324	335	345	355	365	374	20.0																							

SIGHT DISTANCE ON VERTICAL CURVES

NEW 10/02

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 3.5 FEET

608.08

VIRGINIA DEPARTMENT OF TRANSPORTATION

A = Algebraic Difference of Grades in Percent	When S > L: $S = \frac{1400}{A} + \frac{L}{2}$																				When S < L: $S = 52.915 \sqrt{\frac{L}{A}}$																				SD-5 Algebraic Difference of Grades in Percent A =
	S = Sight Distance in Feet																																								
	L = Length of Vertical Curve in Feet																																								
	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000																					
2.0	1225	1250	1275	1300	1325	1350	1375	1400	1425	1449	1473	1497	1520	1543	1565	1587	1609	1631	1652	1673	2.0																				
2.5	1085	1100	1135	1159	1183	1207	1230	1252	1274	1296	1318	1339	1359	1380	1400	1420	1439	1459	1478	1497	2.5																				
3.0	990	1013	1036	1058	1080	1102	1122	1143	1163	1183	1203	1222	1241	1260	1278	1296	1314	1332	1349	1366	3.0																				
3.5	917	938	959	980	1000	1020	1039	1058	1077	1095	1114	1131	1149	1166	1183	1200	1217	1233	1249	1265	3.5																				
4.0	857	877	897	917	935	954	972	990	1007	1025	1042	1058	1075	1091	1107	1122	1138	1153	1168	1183	4.0																				
4.5	808	827	846	864	882	899	917	933	950	966	982	998	1013	1028	1043	1058	1073	1087	1102	1116	4.5																				
5.0	767	785	802	820	837	853	869	885	901	917	932	947	961	976	990	1004	1018	1032	1045	1058	5.0																				
5.5	731	748	765	782	798	814	829	844	859	874	888	903	917	930	944	957	970	983	996	1009	5.5																				
6.0	700	716	733	748	764	779	794	808	823	837	850	864	877	891	904	917	929	942	954	966	6.0																				
6.5	673	688	704	719	734	748	763	777	790	804	817	830	843	856	868	881	893	905	917	928	6.5																				
7.0	648	663	678	693	707	721	735	748	762	775	787	800	812	825	837	849	860	872	883	894	7.0																				
7.5	626	641	655	669	683	697	710	723	736	748	761	773	785	797	808	820	831	842	853	864	7.5																				
8.0	606	620	634	648	661	675	687	700	712	725	737	748	760	771	783	794	805	815	826	837	8.0																				
8.5	588	602	615	629	642	654	667	679	691	703	715	726	737	748	759	770	781	791	801	812	8.5																				
9.0	572	585	598	611	624	636	648	660	672	683	694	706	716	727	738	748	759	769	779	789	9.0																				
9.5	556	569	582	595	607	619	631	642	654	665	676	687	697	708	718	728	738	748	758	768	9.5																				
10.0	542	555	567	580	592	603	615	626	637	648	659	669	680	690	700	710	720	729	739	748	10.0																				
10.5	529	542	554	566	577	589	600	611	622	632	643	653	663	673	683	693	702	712	721	730	10.5																				
11.0	517	529	541	553	564	575	586	597	608	618	628	638	648	658	667	677	686	695	705	714	11.0																				
11.5	506	518	529	541	552	563	573	584	594	604	614	624	634	643	653	662	671	680	689	698	11.5																				
12.0	495	507	518	529	540	551	561	572	582	592	601	611	620	630	639	648	657	666	675	683	12.0																				
12.5	485	496	508	518	529	540	550	560	570	580	589	599	608	617	626	635	644	652	661	669	12.5																				
13.0	476	487	498	508	519	529	539	549	559	568	578	587	596	605	614	623	631	640	648	656	13.0																				
13.5	467	478	488	499	509	519	529	539	548	558	567	576	585	594	602	611	619	628	636	644	13.5																				
14.0	458	469	480	490	500	510	520	529	539	548	557	566	574	583	592	600	608	616	624	632	14.0																				
14.5	450	461	471	481	491	501	511	520	529	538	547	556	564	573	581	590	598	606	614	621	14.5																				
15.0	443	453	463	473	483	493	502	511	520	529	538	547	555	563	572	580	588	596	603	611	15.0																				
16.0	429	439	449	458	468	477	486	495	504	512	521	529	537	545	553	561	569	577	584	592	16.0																				
17.0	416	426	435	445	454	463	472	480	489	497	505	513	521	529	537	544	552	559	567	574	17.0																				
18.0	404	414	423	432	441	450	458	467	475	483	491	499	507	514	522	529	536	544	551	558	18.0																				
19.0	393	403	412	421	429	438	446	454	462	470	478	486	493	501	508	515	522	529	536	543	19.0																				
20.0	383	392	401	410	418	427	435	443	451	458	466	473	481	488	495	502	509	516	522	529	20.0																				

SIGHT DISTANCE ON VERTICAL CURVES

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 3.5 FEET

NEW 10/02

STANDARD SYMBOLS

- LOCATION ⓈALIGNMENT ON WHICH THE PROPOSED RIGHT-OF-WAY AND CONSTRUCTION IS BASED.
- STANDARD PAVEMENT.....THE TYPICAL PAVEMENT SECTION TO BE SHOWN ON THE ROAD PLANS.
- P.C.POINT OF BEGINNING OF BASELINE CIRCULAR CURVE.
- P.T.POINT OF ENDING OF BASELINE CIRCULAR CURVE.
- P.C.C.POINT OF BASELINE COMPOUND CURVATURE.
- P.R.C.....POINT OF BASELINE REVERSE CURVE.
- T.S.POINT OF CHANGE FROM TANGENT TO TRANSITION CURVE. (TANGENT TO SPIRAL)
- S.C.POINT OF CHANGE FROM TRANSITION CURVE TO CIRCULAR CURVE. (SPIRAL TO CIRCULAR)
- C.S.POINT OF CHANGE FROM CIRCULAR CURVE TO TRANSITION CURVE. (CIRCULAR TO SPIRAL)
- S.T.POINT OF CHANGE FROM TRANSITION CURVE TO TANGENT. (SPIRAL TO TANGENT)
- RADIUSRADIUS OF BASELINE CIRCULAR CURVE.
- DVAPPROXIMATE MAXIMUM SAFE SPEED IN MILES PER HOUR USING STANDARD RATE OF SUPER-ELEVATION.
- NCAPPROXIMATE MAXIMUM SAFE SPEED IN MILES PER HOUR WITH NO SUPERELEVATION.
- LSLENGTH OF TRANSITION CURVE MEASURED ALONG BASELINE. WHERE NO TRANSITION CURVE IS APPLIED LS IS LENGTH OF SUPERELEVATION TRANSITION.
- W OR PWWIDTH OF STANDARD PAVEMENT.
- ZTDISTANCE FROM TRANSITIONED BASELINE TO EDGES OF TRANSITIONED PAVEMENT
- wMAXIMUM TOTAL PAVEMENT WIDENING.
- ERATE OF SUPERELEVATION.
- FSAFE SIDE FRICTION FACTOR.
- SAMOUNT OF SUPERELEVATION TO BE APPLIED TO THE BASELINE GRADE TO OBTAIN THE ELEVATIONS OF THE EDGES OF TRANSITIONED PAVEMENT.
- CDIFFERENCE IN ELEVATION BETWEEN BASELINE (CENTER) AND EDGE OF PAVEMENT FOR STANDARD PAVEMENT CROWN.
- CRSTANDARD PAVEMENT CROWN TRANSITION OR CROWN RUNOFF LENGTH.
- CPCHORD POINT (1/10 INCREMENTS OF TRANSITION CURVE).
- NPC.....NORMAL PAVEMENT CROWN.

ALL DISTANCES (HORIZONTAL AND VERTICAL) ARE MEASURED IN FEET.

SPECIFICATION REFERENCE

TRANSITION CURVES FOR RURAL AND URBAN
HIGHWAYS AND STREET CONDITIONS

URBAN CONDITION

URBAN CONDITIONS APPLY TO URBAN STREET SYSTEMS AND ANY OTHER ROAD WITH PRESENT OR FUTURE URBAN STREET OPERATING CONDITIONS.

THESE TABLES CONTAIN THE MINIMUM SUPERELEVATION RATES AND TRANSITION LENGTHS FOR STANDARD URBAN PAVEMENT WIDTHS THROUGH A RANGE OF DESIGN VELOCITIES CONSIDERED MOST LIKELY TO BE USED IN URBAN ROAD DESIGN.

DEFINITIONS FOR THE STANDARD SYMBOLS USED THROUGHOUT THESE TABLES ARE FOUND ON [SHEET 802.01](#).

A TABLE FOR "LOW SPEED URBAN" DESIGNS IS ON [SHEET 802.24](#) WITH A RANGE OF STANDARD PAVEMENT WIDTHS (W), TRANSITION LENGTHS (LS), AND RADII OF CURVE WHEN SUPERELEVATED BY AN AMOUNT EQUAL TO THE NORMAL CROWN AND THE APPROXIMATE MAXIMUM SAFE SPEEDS (DV) AFFORDED THEREBY. VALUES IN THIS TABLE CAN BE USED ON STREETS WITH OPERATING SPEEDS LESS THAN OR EQUAL TO 45 MPH. ALSO SHOWN ARE THE APPROXIMATE MAXIMUM SAFE SPEEDS (NC) WITH NO SUPERELEVATION. VALUES FOR (NC) CAN BE USED ON URBAN ARTERIAL, COLLECTOR, AND LOCAL STREETS.

FOR MINIMUM DESIGN FACTORS FOR VARIOUS DESIGN SPEEDS FOR URBAN CONDITIONS SEE [SHEETS 802.25 THRU 802.33](#)

WHEN URBAN CONDITIONS APPLY THERE WILL BE NO BASELINE TRANSITION OR PAVEMENT WIDENING. THE LENGTH OF TRANSITION (LS) DETERMINES THE LENGTH OF SUPERELEVATION TRANSITION THROUGH WHICH THE OUTER EDGE OF PAVEMENT IS RAISED ABOVE THE BASELINE GRADE TO A MAXIMUM OF $E \left(\frac{W}{2}\right)$. SEE [SHEET 802.07](#) FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

FOR CURVE RADII NOT LISTED IN TABLES REFER TO [SHEET 802.22](#) TO CALCULATE TRANSITION LENGTHS (LS).

LS SHOULD BE SHOWN ON THE PLANS FOR ALL CURVES.

E SHOULD BE SHOWN ON THE PLANS FOR ALL CURVES WITH URBAN STREET CONDITIONS.

FOR GRAPHICAL ILLUSTRATION OF DESIGN SUPERELEVATION RATES FOR URBAN CONDITIONS SEE SHEET 802.19.

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE [SHEET 802.04](#).

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE
URBAN CONDITION

RURAL CONDITION

RURAL CONDITIONS APPLY TO INTERSTATE, ARTERIAL, PRIMARY AND SECONDARY SYSTEMS OR TO ANY OTHER ROAD WITH RURAL TYPE DESIGN AND OPERATING CONDITIONS.

THESE TABLES CONTAIN THE MINIMUM ALLOWABLE SUPERELEVATION, TRANSITION LENGTHS, AND WIDENING CORRECTIONS FOR STANDARD RURAL PAVEMENT WIDTHS THROUGH A RANGE OF DESIGN VELOCITIES CONSIDERED MOST LIKELY TO BE USED IN RURAL HIGHWAY DESIGN.

DEFINITIONS FOR THE STANDARD SYMBOLS USED THROUGHOUT THESE TABLES ARE FOUND ON [SHEET 802.01](#).

FOR MINIMUM DESIGN FACTORS FOR VARIOUS DESIGN SPEEDS FOR RURAL CONDITIONS SEE [SHEETS 802.34 THRU 802.44](#).

ON CURVES WITH GREATER THAN 2865 FT RADIUS, THERE WILL BE NO SPIRAL TRANSITION OR PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THE TABLES. SEE [SHEET 802.06](#) FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

ON CURVES WITH PAVEMENT WIDTHS OF 24' OR WIDER AND A RADIUS OF 882 FT. OR GREATER, THERE WILL BE NO SPIRAL TRANSITION OR PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THESE TABLES.

FOR CURVE RADII NOT LISTED IN TABLES, REFER TO [SHEET 802.22](#) TO CALCULATE TRANSITION LENGTHS (LS) AND PAVEMENT WIDENING (w).

LS AND E SHOULD BE SHOWN ON THE PLANS FOR ALL CURVES..

FOR GRAPHICAL ILLUSTRATION OF DESIGN SUPERELEVATION RATES FOR RURAL CONDITIONS SEE SHEET 802.20.

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE [SHEET 802.04](#).

SEE [SHEET 802.05](#) FOR A GRAPHICAL ILLUSTRATION OF SPIRAL TRANSITIONS.

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE
RURAL CONDITION

VIRGINIA DEPARTMENT OF TRANSPORTATION

GENERAL CONDITION

ALL ORIGINAL CROSS SECTIONS SHALL BE TAKEN FROM THE BASELINE AT STATIONS, PLUS FIFTIES, AND UNUSUAL BREAKS IN THE GROUND AS ON TANGENT ALIGNMENT.

WHERE A PART OR ALL OF A SUPERELEVATION TRANSITION CURVE FALLS ON A VERTICAL CURVE, ELEVATIONS ON THE VERTICAL CURVE SHOULD BE COMPUTED FOR THE POSITIONS GIVEN ON [SHEET 802.16](#) FOR CROWN TRANSITIONS, [SHEET 802.17](#) FOR URBAN PROJECTS AND [SHEET 802.18](#) FOR RURAL PROJECTS. THESE ELEVATIONS AND PLUSES SHOULD BE SHOWN ON THE PLANS FOR THE CONVENIENCE OF THE SURVEY PARTY IN STAKING OUT THE PROJECT. THROUGHOUT THESE SECTIONS OF THE GRADE, ELEVATIONS AT EVEN STATIONS AND PLUS FIFTIES SHOULD BE OMITTED.

SLOPE STAKES SHOULD BE SET AT THE POSITIONS ON THE TRANSITION GIVEN ON SHEETS 802.16, 802.17 AND 802.18 AND GROUND CROSS SECTIONS TAKEN AT THESE POSITIONS OMITTING THE STATIONS AND PLUS FIFTIES THROUGHOUT THE TRANSITION. IF UNUSUAL BREAKS IN THE GROUND OCCUR, ADDITIONAL SECTIONS SHOULD, OF COURSE, BE TAKEN. ADDITIONAL SECTIONS SHOULD ALSO BE TAKEN WHERE LOCATION IS THROUGH ROCK CUT IN ANTICIPATION OF UNUSUAL BREAKAGE WHICH MAY OCCUR DURING CONSTRUCTION.

AFTER ROUGH GRADING HAS BEEN DONE, FINE GRADING (BLUE TOP) AND FORM STAKES SHOULD BE SET AT THE POSITIONS GIVEN ON SHEET 802.16 FOR CROWN TRANSITIONS, SHEET 802.17 FOR URBAN PROJECTS OR AS GIVEN ON SHEET 802.18 FOR RURAL PROJECTS.

FINAL CROSS SECTIONS SHOULD, OF COURSE, BE TAKEN AT THOSE POSITIONS AT WHICH THE SLOPE STAKE SECTIONS WERE TAKEN. WHERE UNUSUAL BREAKAGE IN ROCK OCCURS, AND THIS WAS NOT ANTICIPATED, ADDITIONAL FINAL SECTIONS SHOULD BE TAKEN AND ORIGINAL GROUND SECTIONS INTERPOLATED.

BASELINE STAKES SHOULD BE SET AT ALL P.C.'S, P.T.'S, T.S.'S, S.T.'S, S.C.'S, AND C.S.'S IN STAKING OUT ALIGNMENT BUT SLOPE STAKES NEED NOT BE SET NOR CROSS SECTIONS TAKEN AT P.C.'S OR P.T.'S EXCEPT WHERE CALLED FOR IN THE ACCOMPANYING TABLES. THE TRANSITION WILL TAKE ITS FORM FROM THE POSITIONS GIVEN ON SHEETS 802.17 AND 802.18.

THE RIGHT OF WAY SHALL, IN ALL CASES, BE REFERENCED FROM THE BASELINE.

THE DESIGNER SHOULD EXERCISE CAUTION IN THE USE OF COMPOUND AND REVERSE CURVES UNLESS TOPOGRAPHICAL OR RIGHT OF WAY RESTRICTIONS MAKE THEIR USE APPROPRIATE. THE USE OF BROKEN-BACK CURVES SHOULD BE AVOIDED EXCEPT WHERE VERY UNUSUAL TOPOGRAPHICAL OR RIGHT OF WAY CONDITIONS MAKE OTHER ALTERNATIVES IMPRACTICAL. THE USE OF BROKEN-BACK CURVES MAY REQUIRE A DESIGN EXCEPTION FROM THE STATE LOCATION AND DESIGN ENGINEER. SEE [SHEETS 802.11 THRU 802.14](#) FOR GENERAL INFORMATION ON COMPOUND, REVERSE AND BROKEN-BACK CURVE INFORMATION. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR SPECIFIC COMPOUND AND REVERSE CURVE DESIGN INFORMATION.

A DESIGN EXCEPTION IS NOT REQUIRED WHEN USING VALUES FROM SHEETS 802.24 THRU 802.44 SINCE THESE TABLES WERE DERIVED WITHIN AASHTO GUIDELINES.

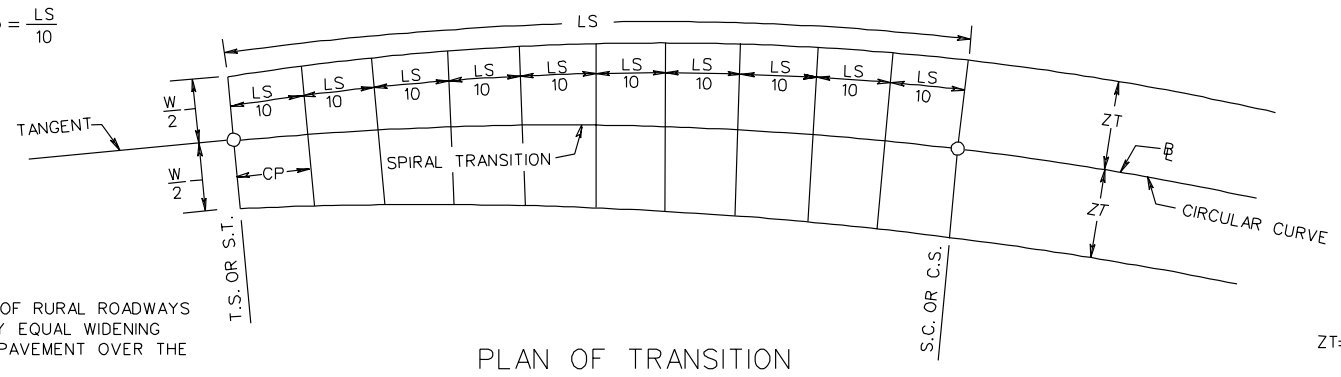
REFER TO APPENDIX A, SECTIONS A-1 AND A-4, OF THE ROAD DESIGN MANUAL FOR INFORMATION ON THE USE OF 18' PAVEMENT WIDTHS (9' LANE WIDTHS).

ALL CROWN RUNOFF (CR) VALUES AND TRANSITION LENGTHS (LS) LISTED IN THE TABLES HAVE BEEN ROUNDED UP TO THE NEAREST FOOT. ALL CR VALUES ARE BASED ON A 2% CROWN.

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE GENERAL CONDITION

VIRGINIA DEPARTMENT OF TRANSPORTATION

CHORD POINTS (CP) = $\frac{LS}{10}$

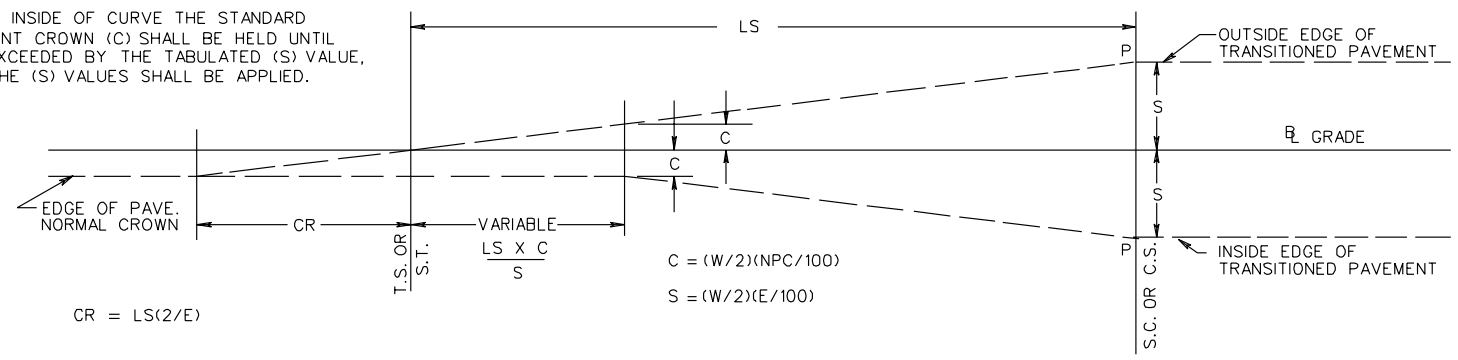


$ZT = \frac{W + w}{2}$

NOTE:
PAVEMENT WIDENING OF RURAL ROADWAYS WILL BE ACHIEVED BY EQUAL WIDENING OF BOTH EDGES OF PAVEMENT OVER THE LS TRANSITION.

PLAN OF TRANSITION

NOTE:
ON THE INSIDE OF CURVE THE STANDARD PAVEMENT CROWN (C) SHALL BE HELD UNTIL IT IS EXCEEDED BY THE TABULATED (S) VALUE, THEN THE (S) VALUES SHALL BE APPLIED.

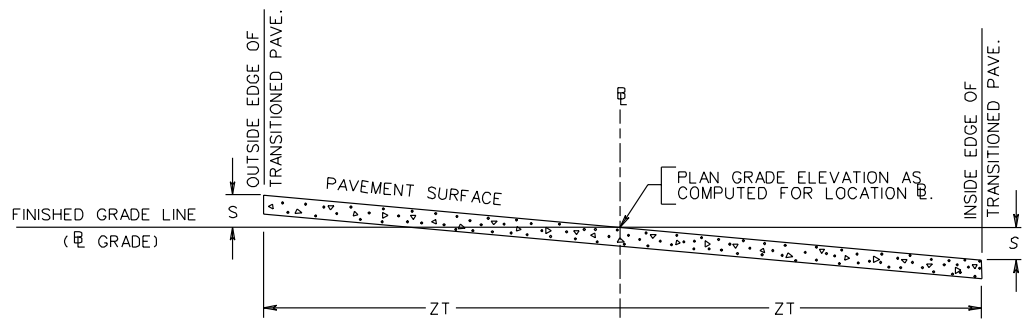


$CR = LS(2/E)$

$C = (W/2)(NPC/100)$
 $S = (W/2)(E/100)$

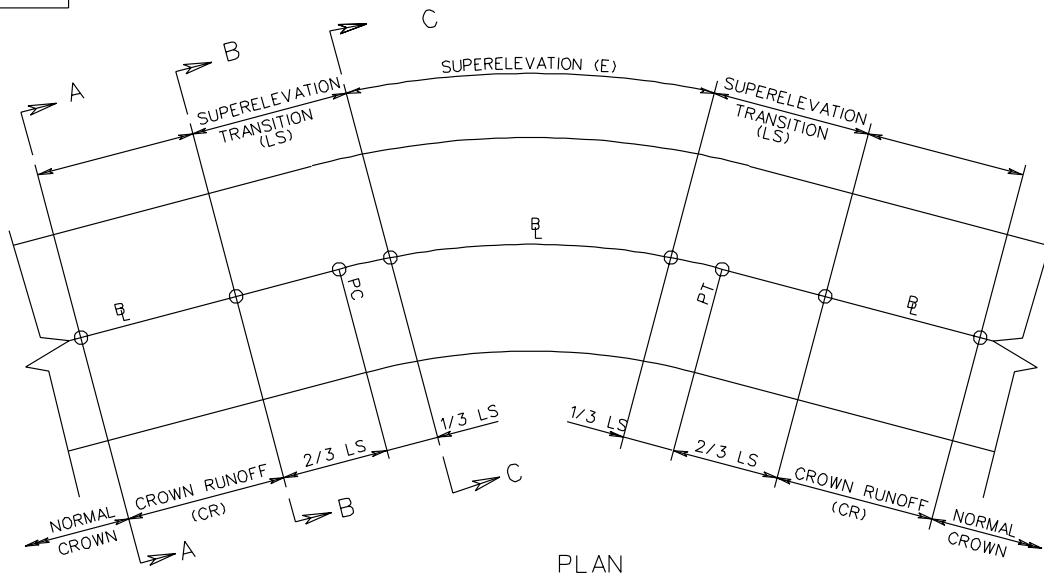
NOTE: SHORT VERTICAL CURVES SHOULD BE INSERTED BY EYE AT POINTS (P) IF CONSIDERED NECESSARY.

PROFILE OF TRANSITION

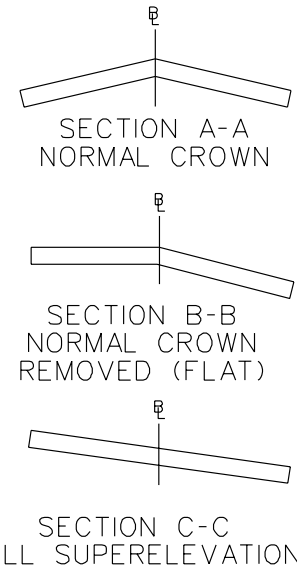


CROSS SECTION THRU TRANSITION

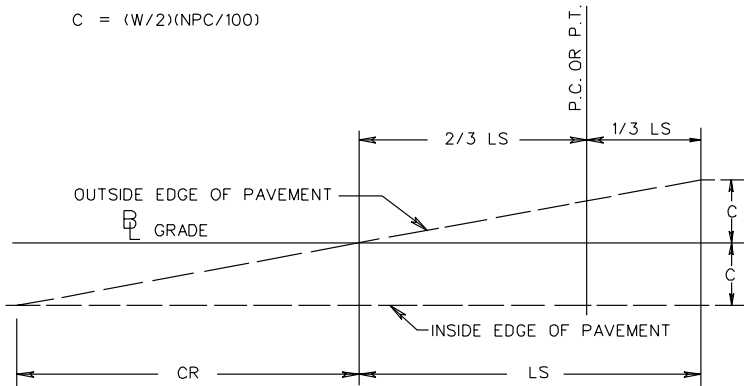
DETAILS FOR TRANSITIONED \bar{E} RURAL CONDITION WITH PAVEMENT WIDENING



$CR = LS(2/E)$

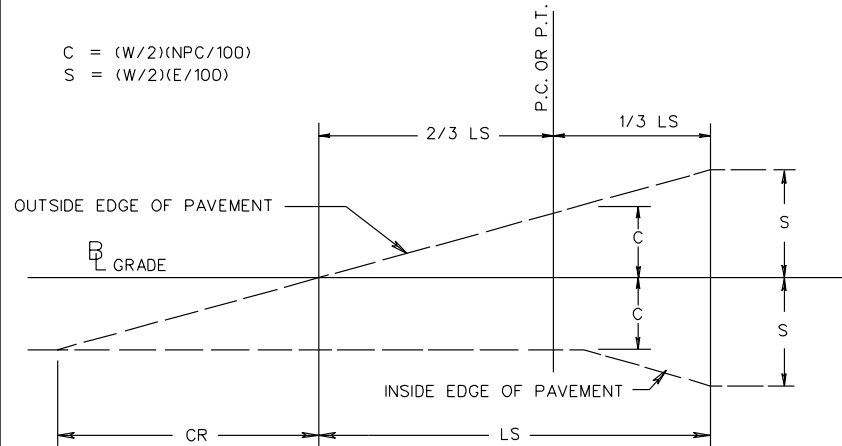


$C = (W/2)(NPC/100)$



SUPERELEVATED BY AN AMOUNT EQUAL TO THE STANDARD PAVEMENT CROWN

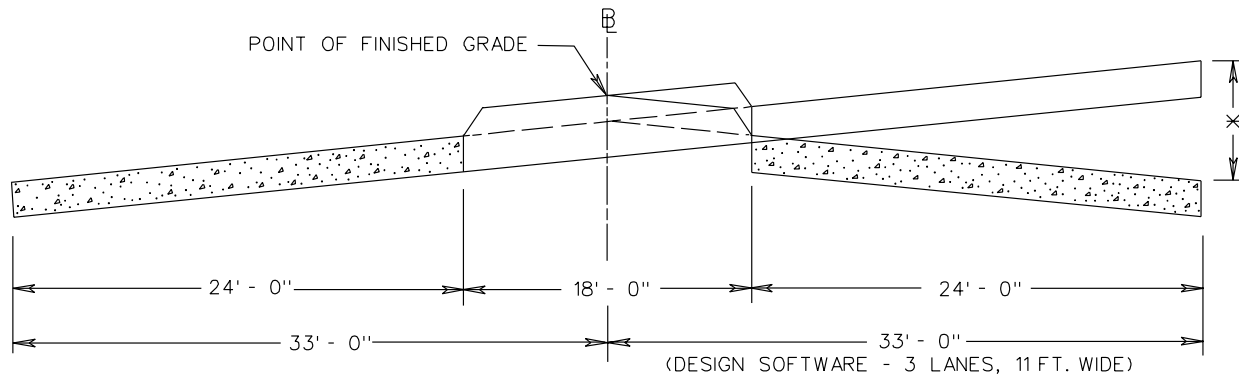
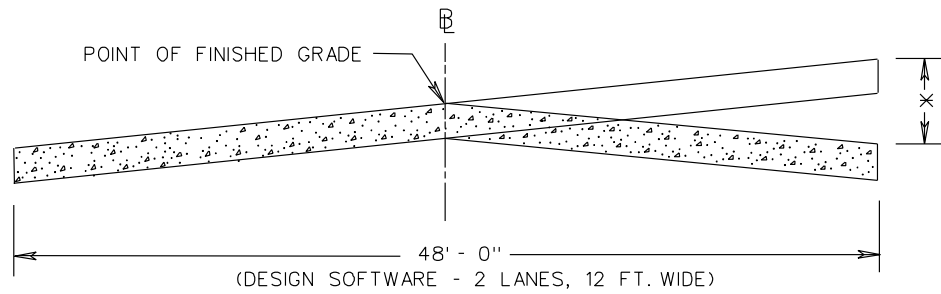
$C = (W/2)(NPC/100)$
 $S = (W/2)(E/100)$



NOTE : ON THE INSIDE OF CURVE THE STANDARD PAVEMENT CROWN (C) SHALL BE HELD UNTIL IT IS EXCEEDED BY THE TABULATED RATE OF SUPERELEVATION (E).

SUPERELEVATED BY AN AMOUNT EXCEEDING THE STANDARD PAVEMENT CROWN

DETAILS FOR NON-TRANSITION \bar{L}
URBAN CONDITIONS AND RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

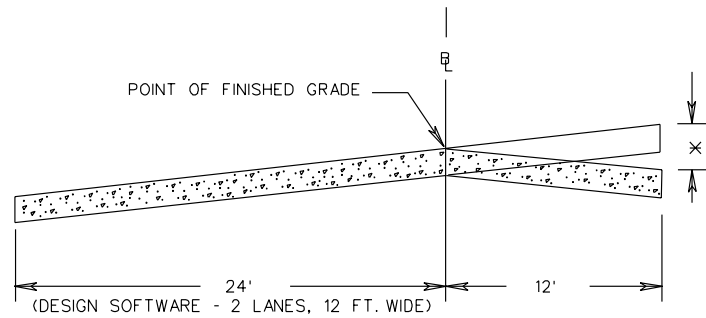


× THE ELEVATION DIFFERENTIAL BETWEEN NORMAL CROWN AND MAXIMUM SUPERELEVATION, RELATIVE TO THE BASELINE PROFILE.

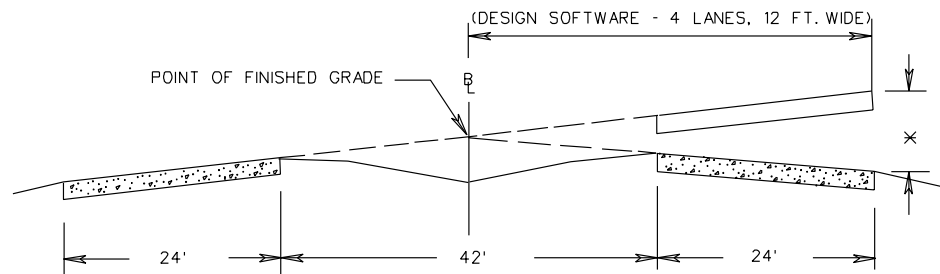
ADDITIONAL INFORMATION MAY BE OBTAINED FROM A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS (AASHTO) BOOK, CHAPTER III - ELEMENTS OF DESIGN (SUPERELEVATION RUNOFF).

ON STANDARD TC-5.01ULS, TC-5.01U, AND TC-5.01R (WITHOUT PAVEMENT WIDENING) SUPERELEVATED CURVES, POSITION THE LS TWO THIRDS (2/3) ON THE TANGENT AND ONE THIRD (1/3) INTO THE CURVE. STATIONS AND ELEVATIONS FOR THESE TRANSITIONS WILL NEED TO BE COMPUTED FOR ALL CHORD POINTS AND SHOWN ON THE PROFILES.

DETAILS OF SUPERELEVATION ABOUT BASELINE



THE PAVEMENT WIDTHS SHOWN IN THE STANDARD TC-5.01 TABLES ON SHEET 802.24 THROUGH 802.44 REPRESENT TWICE THE DISTANCE FROM THE CROWNLINER TO THE EDGE OF PAVEMENT ON THE HIGH SIDE.



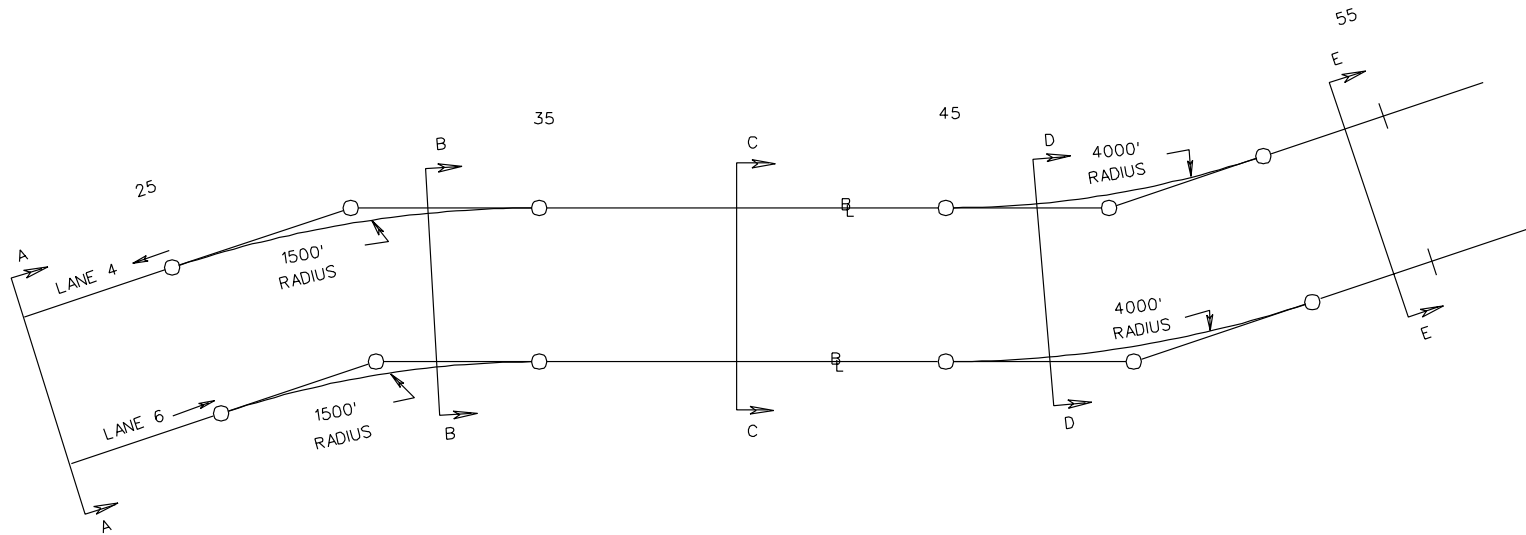
* THE ELEVATION DIFFERENTIAL BETWEEN NORMAL CROWN AND MAXIMUM SUPERELEVATION, RELATIVE TO THE BASELINE PROFILE.

ADDITIONAL INFORMATION MAY BE OBTAINED FROM A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS (AASHTO) BOOK, CHAPTER III - ELEMENTS OF DESIGN (SUPERELEVATION RUNOFF).

PROJECTS IN WHICH LANES MAY BE ADDED IN THE FUTURE IN THE MEDIAN AREA SHOULD BE DESIGNED WITH THE CONSTRUCTION BASELINE AND POINT OF FINISHED GRADE LOCATED IN THE MIDDLE OF THE MEDIAN. SUPERELEVATION IS TO BE ROTATED FROM THIS BASELINE POINT. THIS WILL PREVENT UNEVEN PAVEMENT PROBLEMS (WHEN ADDITIONAL LANES ARE ADDED IN THE MEDIAN AREA) SUCH AS CROSSOVER GRADES AS WELL AS THE NEED FOR RETAINING WALLS, MEDIAN BARRIERS AND SPECIAL DESIGN DRAINAGE STRUCTURES. ADDITIONAL RIGHT OF WAY OR EASEMENTS, IN MOST SITUATIONS, WILL NOT BE REQUIRED.

DETAILS OF SUPERELEVATION ABOUT BASELINE

VIRGINIA DEPARTMENT OF TRANSPORTATION

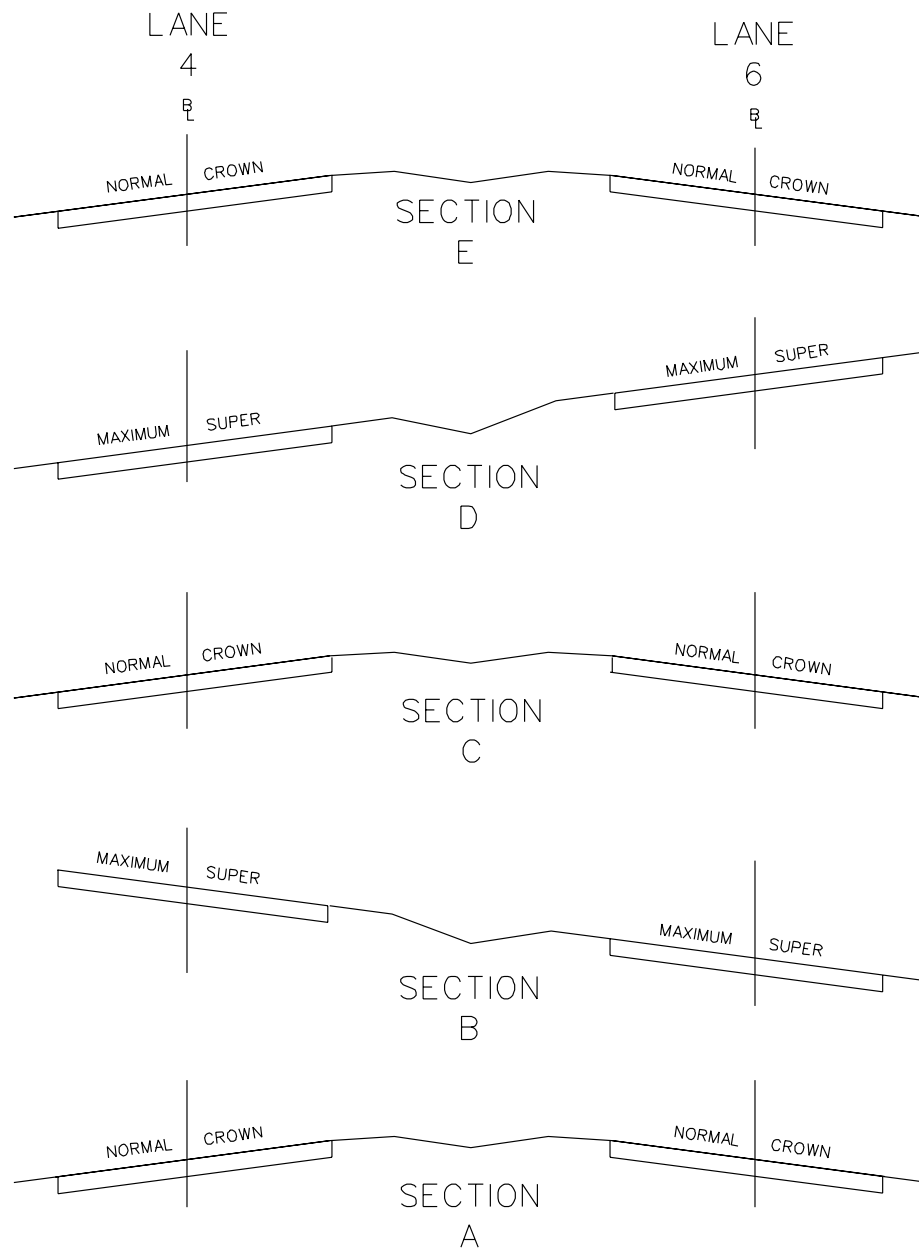


NOTE:

WHEN B (CROWLINE) IS ON THE INSIDE EDGE OF PAVEMENT, TANGENT SECTIONS ARE TO BE CODED AS STRAIGHT.

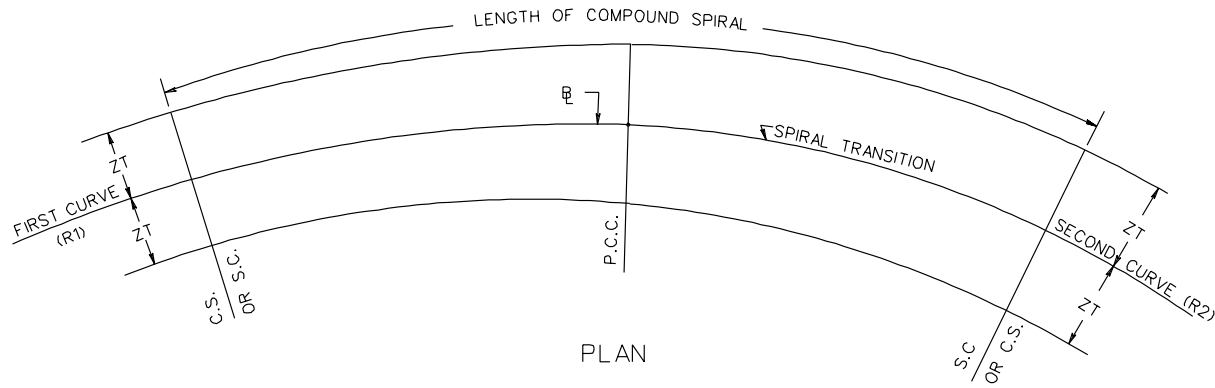
EXAMPLE FOR FOUR LANE ROADWAYS

VIRGINIA DEPARTMENT OF TRANSPORTATION

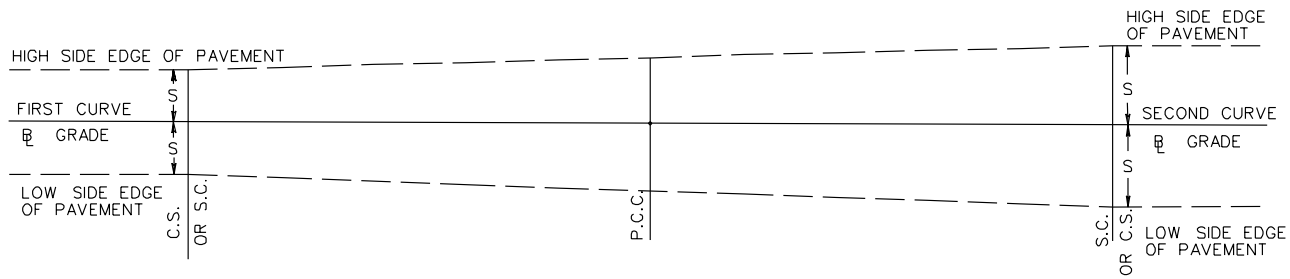


CROSS SECTION - FOUR LANE ROADWAY

VIRGINIA DEPARTMENT OF TRANSPORTATION



PLAN



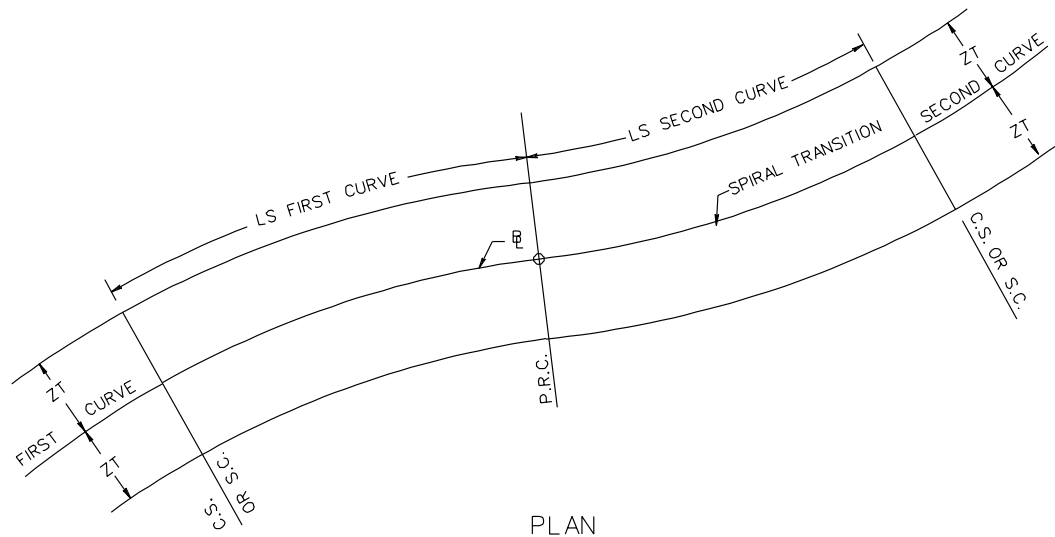
PROFILE

NOTE:

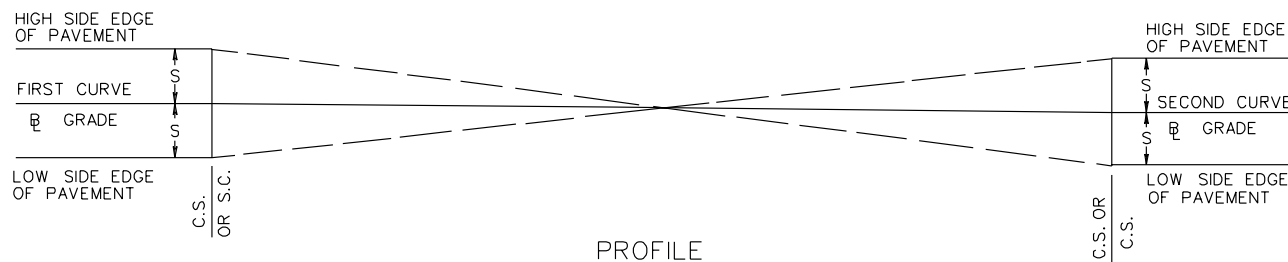
1. FOR COMPOUND CURVES ON ROADWAYS, THE RATIO OF FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 1.5:1.
2. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
3. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL COMPOUND CURVE DESIGN INFORMATION.

SPECIFICATION REFERENCE

METHOD OF APPLYING TC-5.01 ON COMPOUND CURVES RURAL CONDITIONS WITH PAVEMENT WIDENING



PLAN



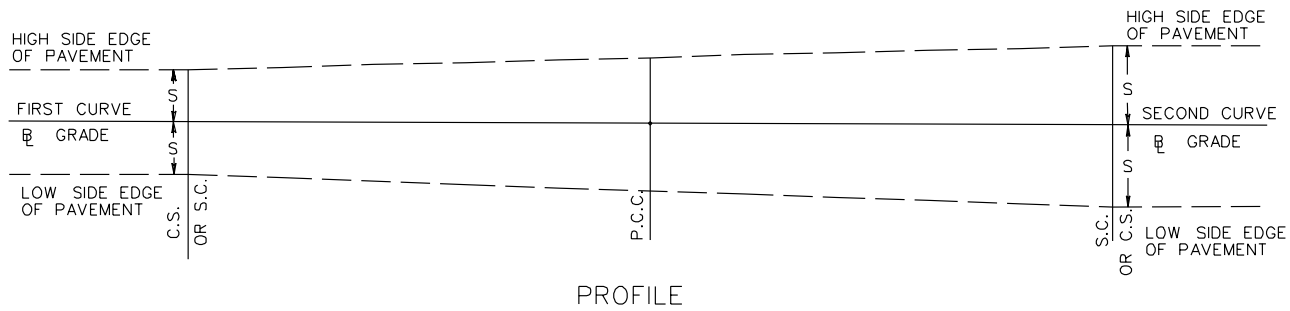
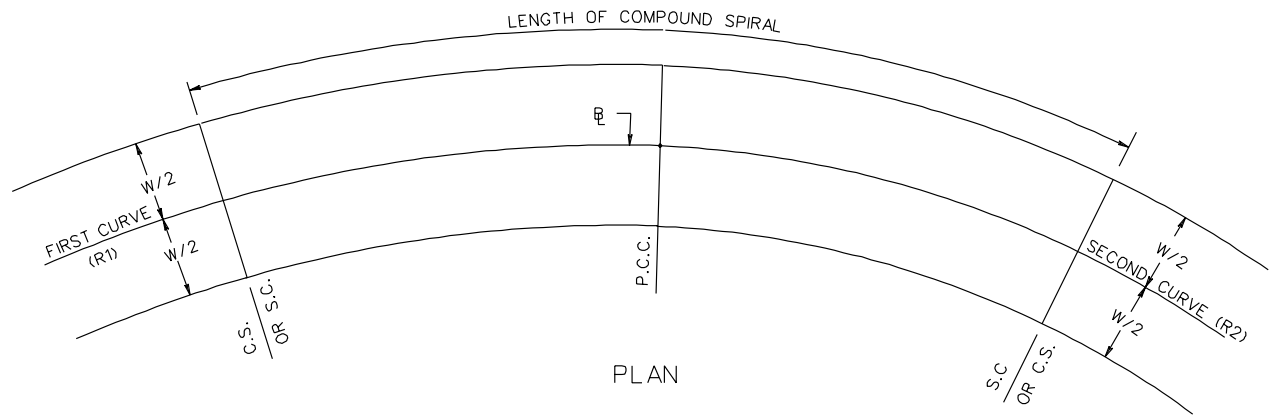
PROFILE

NOTE:

1. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
2. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.

METHOD OF APPLYING TC-5.01 ON REVERSE CURVES
RURAL CONDITIONS WITH PAVEMENT WIDENING

SPECIFICATION
REFERENCE



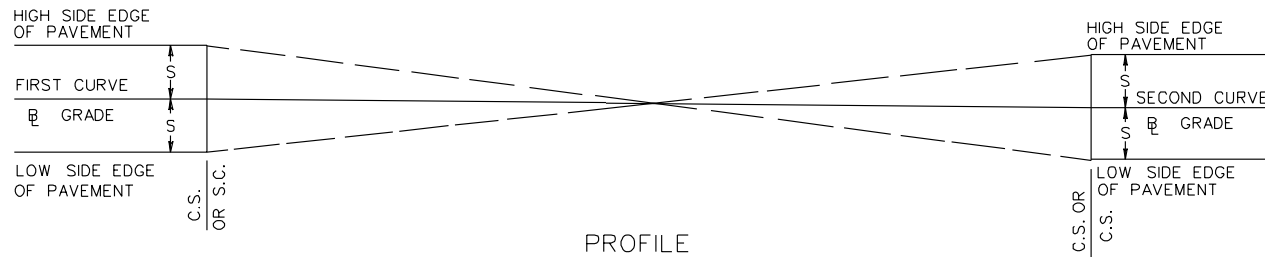
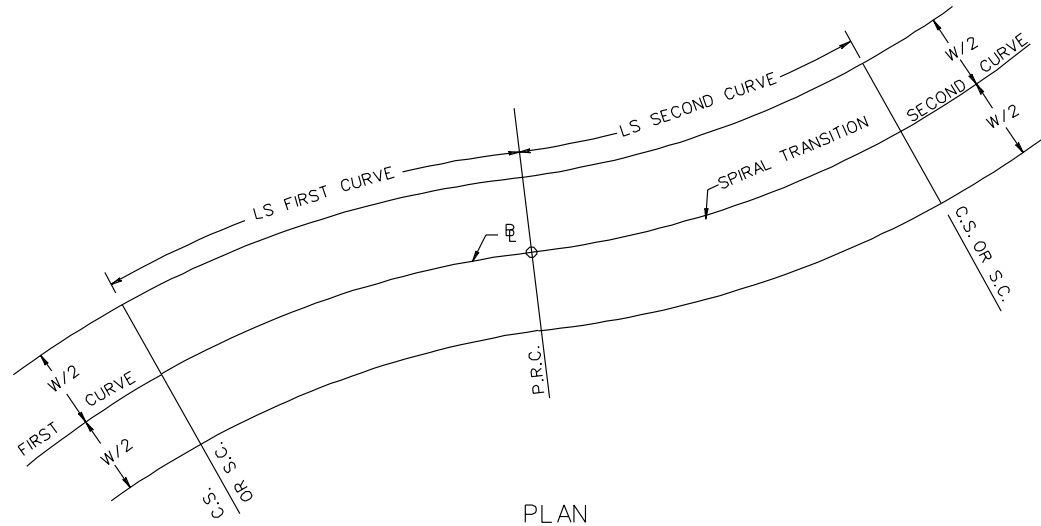
NOTE:

1. FOR COMPOUND CURVES ON ROADWAYS, THE RATIO OF FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 1.5:1 WHERE PRACTICAL, A DESIRABLE MAXIMUM RATIO OF 1.75:1 SHOULD BE USED. FOR COMPOUND CURVES ON RAMPS, THE RATIO OF THE FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 2:1.
2. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF COMPOUND SPIRAL COMPUTED PER THE FOURTH EDITION OF AASHTO'S A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS.
3. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL COMPOUND CURVE DESIGN INFORMATION.

SPECIFICATION REFERENCE

METHOD OF APPLYING TC-5.01 ON COMPOUND CURVES
URBAN CONDITIONS & RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION



NOTE:

1. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF LS (SPIRAL TRANSITIONS) COMPUTED PER FOURTH EDITION OF AASHTO'S A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS.
2. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.

METHOD OF APPLYING TC-5.01 ON REVERSE CURVES
 URBAN CONDITIONS & RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

SPECIFICATION
 REFERENCE

THIS SHEET INTENTIONALLY LEFT BLANK

SPECIFICATION REFERENCE

TRANSITION TABLE

LENGTH OF CROWN RUNOFF (CR)	START/END OF TRANSITION (LS)	DISTANCE IN FEET FROM START/END OF TRANSITION (LS)				NORMAL CROWN
		1	2	3	4	
220	0	44	88	132	176	220
200	0	40	80	120	140	200
180	0	36	72	108	144	180
160	0	32	64	96	128	160
140	0	28	56	84	112	140
120	0	24	48	72	96	120
100	0	20	40	60	80	100
90	0	18	36	54	72	90
80	0	16	32	48	64	80
60	0	15	30	45	———	60
40	0	20	———	———	———	40

NOTE:

TABLE LISTS POSITIONS ON TRANSITIONS AT WHICH SLOPE STAKES SHOULD BE SET,
CONSTRUCTION AND FINAL CROSS-SECTIONS TAKEN, FINE GRADING STAKES (BLUE TOP)
SET, AND FORM STAKES SET (CONCRETE PAVEMENT ONLY).

CROWN TRANSITION / CROWN RUNOFF (CR) TABLE

VIRGINIA DEPARTMENT OF TRANSPORTATION

URBAN CONDITIONS RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT
(LS POSITIONED 2/3 ± ON TANGENT, 1/3 ± ON CURVE)

LENGTH OF TRANSITION (LS)	END/BEGIN CROWN RUNOFF (CR)	DISTANCE IN FEET FROM P.C. OR P.T. ON TANGENT						P.C. OR P.T.	DISTANCE IN FEET FROM P.C. OR P.T. ON CURVE			FULL SUPER ELEVATION (E)
		1	2	3	4	5	6		7	8	9	
480	320	272	224	176	128	80	32	STAKE	16	64	112	160
460	307	261	215	169	123	77	31	STAKE	15	61	107	153
440	293	249	205	161	117	73	29	STAKE	15	59	103	147
420	280	238	196	154	112	70	28	STAKE	14	56	98	140
400	267	227	187	147	107	67	27	STAKE	13	53	93	133
380	253	215	177	139	101	63	25	STAKE	13	51	89	127
360	240	204	168	132	96	60	24	STAKE	12	48	84	120
340	227	193	159	125	91	57	23	STAKE	11	45	79	113
320	213	181	149	117	85	53	21	STAKE	11	43	75	107
300	200	170	140	110	80	50	20	STAKE	10	40	70	100
280	187	159	131	103	75	47	19	STAKE	9	37	65	93
260	173	147 *	121	95 *	69	43 *	17	STAKE *	9	35 *	61	87
240	160	136 *	112	88 *	64	40 *	16	STAKE *	8	32 *	56	80
220	147	125 *	103	81 *	59	37 *	15	STAKE *	7	29 *	51	73
200	133	113 *	93	73 *	53	33 *	13	STAKE *	7	27 *	47	67
180	120	102 *	84	66 *	48	30 *	12	STAKE *	6	24 *	42	60
160	107	91 *	75	59 *	43	27 *	11	STAKE *	5	21 *	37	53

NOTE :

TABLE GIVING POSITIONS ON CURVES AT WHICH SLOPE STAKES SHOULD BE SET, CONSTRUCTION AND FINAL CROSS-SECTIONS TAKEN, FINE GRADING STAKES (BLUE TOP) SET, AND FORM STAKES SET (CONCRETE PAVEMENT ONLY).

* DENOTES ADDITIONAL STAKING POSITIONS FOR USE WITH CONCRETE PAVEMENT ONLY.

TABLE I

RURAL CONDITIONS WITH PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT

LENGTH OF TRANSITION (LS)	T.S. OR S.T.	DISTANCE IN FEET FROM T.S. OR S.T. ALONG SPIRAL TRANSITION									S.C. OR C.S.
		1	2	3	4	5	6	7	8	9	
480	0	48	96	144	192	240	288	336	384	432	480
460	0	46	92	138	184	230	276	322	368	414	460
440	0	44	88	132	176	220	264	308	352	396	440
420	0	42	84	126	168	210	252	294	336	378	420
400	0	40	80	120	160	200	240	280	320	360	400
380	0	38	76	114	152	190	228	266	304	342	380
360	0	36	72	108	144	180	216	252	288	324	360
340	0	34	68	102	136	170	204	238	272	306	340
320	0	32	64	96	128	160	192	224	256	288	320
300	0	30	60	90	120	150	180	210	240	270	300
280	0	28	56	84	112	140	168	196	224	252	280
260	0	26 *	52	78 *	104	130 *	156	182 *	208	234 *	260
240	0	24 *	48	72 *	96	120 *	144	168 *	192	216 *	240
220	0	22 *	44	66 *	88	110 *	132	154 *	176	198 *	220
200	0	20 *	40	60 *	80	100 *	120	140 *	160	180 *	200
180	0	18 *	36	54 *	72	90 *	108	126 *	144	162 *	180
160	0	16 *	32	48 *	64	80 *	96	112 *	128	144 *	160

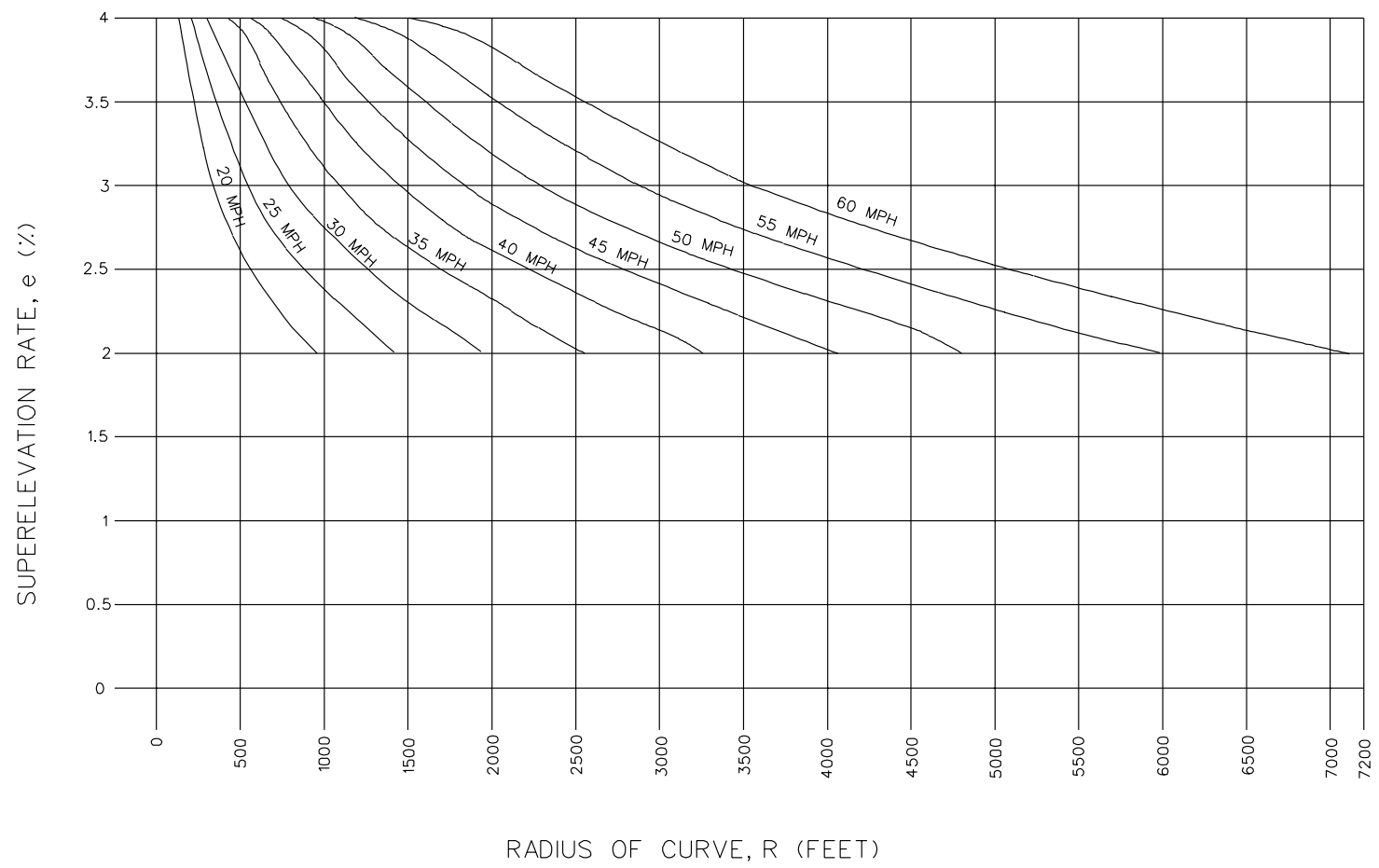
NOTE :

TABLE GIVING POSITIONS ON TRANSITION CURVES AT WHICH SLOPE STAKES SHOULD BE SET,
CONSTRUCTION AND FINAL CROSS-SECTIONS TAKEN, FINE GRADING STAKES (BLUE TOP) SET,
AND FORM STAKES SET (CONCRETE PAVEMENT ONLY).

* DENOTES ADDITIONAL STAKING POSITIONS FOR USE WITH CONCRETE PAVEMENT ONLY.

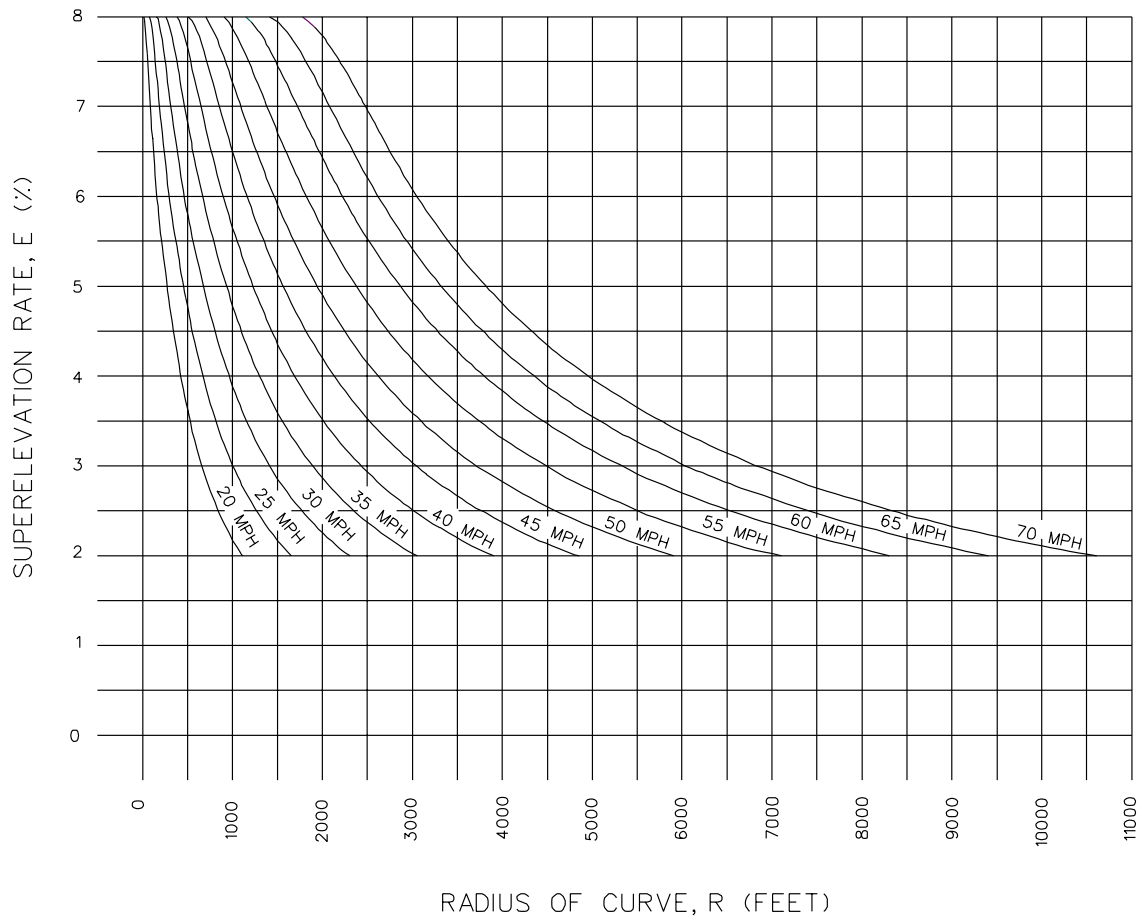
TABLE 2

VIRGINIA DEPARTMENT OF TRANSPORTATION



DESIGN SUPERELEVATION RATES
URBAN CONDITIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION



DESIGN SUPERELEVATION RATES
RURAL CONDITIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION

URBAN LOW SPEED DESIGN TABLE

DV/NC (MPH)	MAX. f	C	MIN. LS (FEET)
45	0.161	2.75	115
40	0.178	3.00	100
35	0.197	3.25	90
30	0.221	3.50	90
25	0.252	3.75	90
20	0.300	4.00	90

GENERAL DESIGN CONSIDERATIONS

1. WHEN "URBAN LOW SPEED" DESIGNS UTILIZE SUPERELEVATION, THEY WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE NORMAL CROWN (TYPICALLY 2.0%) AND THE APPROXIMATE MAXIMUM SAFE SPEED (DV) AFFORDED THEREBY.
2. WHEN "URBAN LOW SPEED DESIGN" WITH NO SUPERELEVATION, THE APPROXIMATE MAXIMUM SAFE SPEED (NC) IS CALCULATED USING A NEGATIVE NORMAL CROWN (TYPICALLY -2.0 %).
3. WHEN THE CURVE IS SUPERELEVATED, THE LS IS APPLIED IN THE SAME MANNER AS IN URBAN CONDITIONS WITH THE CROWN RUNOFF (CR) BEING EQUAL TO THE LS VALUE. THE CROWN RUNOFF (CR) IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION (LS).
4. PLEASE NOTE THAT THE RADIUS VALUES LISTED ON PAGE 802.24 HAVE BEEN ROUNDED UP TO THE NEAREST FOOT.

LEGEND

- C- RATE OF CHANGE OF SIDE FRICTION (f) IN FT./SEC.³
- e- SUPERELEVATION RATE.
- f- FRICTION FACTOR.
- LS- LENGTH OF SUPERELEVATION TRANSITION.
- R- RADIUS OF CURVE.
- DV- DESIGN VELOCITY UTILIZING SUPERELEVATION.
- NC- MAXIMUM VELOCITY WITH NO SUPERELEVATION (NORMAL CROWN).

FRICTION FACTORS (f) FOR ODD VELOCITIES NOT LISTED SHOULD BE DERIVED BY INTERPOLATION.

FOR LS LENGTHS FOR INTERMEDIATE VELOCITIES NOT LISTED IN TABLE USE THE LS FOR NEAREST VELOCITY IN TABLE.

EXAMPLES

DV = 21 mph
e = +2.0 %

f = MAX f ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS
f = 0.300 - [1/5(0.300 - 0.252)] = 0.2904 (ROUND TO 0.29)

LS = 47.2 f DV/C

LS = 47.2(0.29)(21)/4 = 71.862 FT.

71.862 < 90 THEREFORE LS = 90 FT.

Rmin. = DV² / 15(e+f)

Rmin. = (21) / 15(0.02 + 0.29) = 94.83870968 FT.

NC = 37 mph

e = -2.0 %

f = MAX f ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS

f = 0.197 - [2/5(0.197 - 0.178)] = 0.1894 (ROUND TO 0.189)

Rmin. = NC² / 15(-e + f)

Rmin. = (37)² / 15(-0.02 + 0.189) = 540.0394477 FT.

METHODOLOGIES FOR CALCULATING TC-5.01 VALUES FOR URBAN LOW-SPEED STREETS

CURVE WIDENING TABLES
SU DESIGN VEHICLE

COMPONENT	SIZE
OVERALL WIDTH (u)	8.0 ft
WHEELBASE (L)	20 ft
FRONT OVERHANG (A)	4 ft

LATERAL CLEARANCE

LANE WIDTH	CLEARANCE (C)
9 ft	1.5 ft
10 ft	2 ft
11 ft	2.5 ft
12 ft	3 ft
16 ft	5 ft

ADJUSTMENT FACTORS

NUMBER OF LANES ROTATED n_1	ADJUSTMENT FACTOR (b_w)
1	1.00
1.5	0.8333
2	0.75
2.5	0.70
3	0.6667
3.5	0.6425

RELATIVE GRADIENTS

DESIGN SPEED V_D MPH	MAXIMUM RELATIVE GRADIENT (rg)	MIN. TRANSITION LENGTH IN FEET RURAL CONDITIONS WITH PAVEMENT WIDENING AND REVERSE CURVES FOR ALL CONDITIONS	
		URBAN	RURAL
20	0.74	100	60
25	0.70	100	80
30	0.66	100	100
35	0.62	120	120
40	0.58	120	120
45	0.54	140	140
50	0.50	160	160
55	0.47	180	180
60	0.45	180	180
65	0.43	200	200
70	0.40	220	220

- A - FRONT OVERHANG OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- b_w - ADJUSTMENT FACTOR FROM TABLE.
- C - LATERAL CLEARANCE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- E - SUPERELEVATION RATE FROM APPROPRIATE TABLE.
- F_A - CALCULATED WIDTH OF OVERHANG FOR DESIGN VEHICLE.
- L - WHEELBASE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- LS - LENGTH OF SPIRAL OR SUPERELEVATION TRANSITION LENGTH.

DEFINITIONS

- M - MULTIPLE LANE FACTOR.
- N - NUMBER OF LANES.
- n_1 - NUMBER OF LANES ROTATED (FROM TABLES).
- P_w - PAVEMENT WIDTH.
- R - RADIUS OF CURVE.
- rg - RELATIVE GRADIENT FROM APPROPRIATE TABLE.
- U - CALCULATED TRACK WIDTH OF DESIGN VEHICLE.

- u - TRACK WIDTH OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- V_D - DESIGN VELOCITY.
- w - CALCULATED WIDENING.
- W - PAVEMENT WIDTH
- W_C - CALCULATED TOTAL CURVE WIDTH.
- W_n - WIDTH OF LANE.
- Z - CALCULATED EXTRA WIDTH ALLOWANCE.

GENERAL DESIGN CONSIDERATIONS

1. WHERE PAVEMENT WIDENING IS REQUIRED, THE APPROPRIATE WIDENING IS ADDED TO THE LANE WIDTH WHEN CALCULATING THE TRANSITION LENGTH (LS).
2. THE COMPUTED TRANSITION LENGTH (LS) IS ROUNDED UP TO THE NEAREST FOOT.
3. WHEN THE TRANSITION LENGTH (LS) IS CALCULATED, IT MUST BE COMPARED WITH THE MINIMUM VALUE LISTED IN THE APPROPRIATE COLUMN ON THE RELATIVE GRADIENT TABLE.
4. CROWN RUNOFF IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION.
5. NO PAVEMENT WIDENING IS REQUIRED FOR URBAN ROADWAYS.
6. NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH A CURVE RADIUS GREATER THAN 2865 FEET.
7. NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH 12 FOOT WIDE LANES AND A CURVE RADIUS GREATER THAN 881 FEET.
8. PAVEMENT WIDENING IS APPLIED ONLY WHEN CALCULATED WIDENING (w) IS EQUAL TO OR GREATER THAN 2 FEET.
9. WHEN CALCULATING WIDENING (w) FOR MULTI-LANE RURAL ROADWAYS, WIDENING IS FIRST CALCULATED USING THE SINGLE LANE WIDTH FOR "W".
10. AN ALTERNATE METHOD FOR MULTI-LANE UNDIVIDED PAVEMENTS (48'). THE LS IS 1.5 TIMES (M*1.5) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS; AND FOR SIX LANE UNDIVIDED PAVEMENTS (72'), THE LS IS TWO TIMES (M*2) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS.
11. CALCULATED WIDENING IS ROUNDED UP TO THE NEAREST 0.1 FOOT.

NO WIDENING REQUIRED FORMULAS USED TO CALCULATE TRANSITION LENGTH (LS) AND WIDENING (w)

$LS = b_w (W_n E / rg)$

$LS = M(WE/rg)$ (ALT. MULTI-LANE)

WIDENING REQUIRED

$LS = b_w [E n_1 (W_n + w/N) / rg]$

$LS = m[E(W + w/N) / rg]$ (ALT. MULTI-LANE)

$U = u + R - \sqrt{R^2 - L^2}$

$F_A = \sqrt{R^2 + A(2L + A)} - R$

$Z = (V_D / \sqrt{R})$

$W_C = N(U + C) + F_A + Z$

$w = W_C - 2W_n$

FOR SOLVED PROBLEMS USING THIS METHODOLOGY, SEE THE EXAMPLES ON PAGE 802.23

METHODOLOGIES FOR CALCULATING TC-5.01 VALUES

RURAL EXAMPLE
20 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 10 FT)

$V_D = 50$ MPH $R = 1000$ FT
 $W_n = 10$ FT $rg = 0.50$
 $E = 7.6$ (7.6% PER 802.40)

$$U = u + R - \sqrt{R^2 - L^2}$$

$$U = 8.0 + 1000 - \sqrt{(1000)^2 - (20)^2}$$

$$U = 8.20002$$

$$F_A = \frac{\sqrt{R^2 + A(2L + A)} - R}{A}$$

$$F_A = \frac{\sqrt{(1000)^2 + 4[2(20) + 4]} - 1000}{4}$$

$$F_A = .087996$$

$$Z = (V_D / \sqrt{R})$$

$$Z = (50 / \sqrt{1000})$$

$$Z = 1.58$$

$$W_C = N(U + C) + F_A + Z$$

$$W_C = 2(8.20002 + 2) + 0.087996 + 1.58$$

$$W_C = 22.0680$$

$$w = W_C - 2W_n = 22.0680 - 2(10) = 2.1$$

($R < 2865$ & $w > 2$ THEREFORE WIDENING IS REQUIRED)

$$LS = [E n_1 (W_n + w/2) / rg] b_w$$

$$LS = [7.6(1)(10 + 2.1/2) / 0.50] 1$$

$$LS = 7.6 (11.05) / 0.50$$

$$LS = 167.96$$

RURAL EXAMPLE
72 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 12 FT)

$V_D = 40$ MPH $R = 500$ FT
 $W_n = 12$ FT $rg = 0.58$
 $E = 8.0$ (8% PER PAGE 802.38)

$$U = u + R - \sqrt{R^2 - L^2}$$

$$U = 8.0 + 500 - \sqrt{(500)^2 - (20)^2}$$

$$U = 8.4002$$

$$F_A = \frac{\sqrt{R^2 + A(2L + A)} - R}{A}$$

$$F_A = \frac{\sqrt{(500)^2 + 4[2(20) + 4]} - 500}{4}$$

$$F_A = .1760$$

$$Z = (V_D / \sqrt{R})$$

$$Z = (40 / \sqrt{500})$$

$$Z = 1.7885$$

$$W_C = 2(U + C) + F_A + Z$$

$$W_C = 2(8.4002 + 3.0) + .1760 + 1.7885$$

$$W_C = 24.7651$$

$$w = W_C - 2W_n = 24.7651 - 2(12) = 0.7651(0.8)$$

FOR 72' PAVEMENT WIDTH

$$w = 3(0.8) = 2.4$$

($R < 881$ & $w > 2$ THEREFORE WIDENING IS REQUIRED)

$$LS = [E n_1 (W_n + w/3) / rg] b_w$$

$$LS = [8 (3) (12 + 2.4/3) / 0.58] 0.6667$$

$$LS = (307.2 / 0.58) 0.6667$$

$$LS = 353.1211$$

OR

$$LS = M[E(W_n + w/N) / rg]$$

$$LS = 2 [8(12 + 4.5/3) / 0.58]$$

$$LS = 2 (102.4 / 0.58)$$

$$LS = 353.1034$$

URBAN EXAMPLES

24 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 12 FT)

$V_D = 40$ MPH $R = 600$ FT
 $W_n = 12$ FT $rg = 0.58$
 $E = 4.0$ (4% PER PAGE 802.29)

$$LS = (W_n n_1 E / rg) b_w$$

$$LS = [12(1)(4) / 0.58] 1.00$$

$$LS = (48 / 0.58)$$

$$LS = 82.7586$$

66 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 11 FT)

$V_D = 40$ MPH $R = 600$ FT
 $W_n = 11$ FT $rg = 0.58$
 $E = 4.0$ (4% PER PAGE 801.29)

$$LS = b_w (W_n n_1 E / rg)$$

$$LS = 0.6667 [11(3)(4) / 0.58]$$

$$LS = 0.6667 (132 / 0.58)$$

$$LS = 151.7317$$

OR

$$LS = M (E W_n / rg)$$

$$LS = 2 [4(11) / 0.58]$$

$$LS = 2 (44 / 0.58)$$

$$LS = 151.7241$$

CALCULATED TC-5.01 EXAMPLES

MINIMUM RADII AND TRANSITION LENGTHS FOR 2% SUPERELEVATION

RADIUS (FEET)	E (%)	F	DV (MPH)	LS (FEET)	
				PAVEMENT WIDTH (W)	
				W ≤ 72 FT.	W > 72 FT.
>738	2.0	.163	45	126	NOTE: FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.
539	2.0	.178	40	113	
377	2.0	.197	35	101	
249	2.0	.221	30	90	
154	2.0	.252	25	80	
84	2.0	.300	20	75	

MINIMUM RADII FOR DESIGNS
UTILIZING NORMAL PAVEMENT CROWN

RADIUS (FEET)	F	NC (MPH)
> 945	.163	45
676	.178	40
462	.197	35
299	.221	30
180	.252	25
96	.300	20

SUMMARY OF STD. TC-5.01 ULS (URBAN-LOW SPEED) DESIGN FACTORS

DESIGN FACTORS FOR A DESIGN SPEED OF 20 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS		
1400	NC	0	0	0	0	0	0	0	0	0	0	0	
961	2.0	33	33	41	41	49	49	55	55	60	60	65	65
884	2.1	33	35	41	43	49	52	55	57	60	63	65	69
810	2.2	33	36	41	45	49	54	55	60	60	66	65	72
735	2.3	33	38	41	47	49	56	55	63	60	69	65	75
653	2.4	33	39	41	49	49	59	55	65	60	72	65	78
578	2.5	33	41	41	51	49	61	55	68	60	75	65	82
516	2.6	33	43	41	53	49	64	55	71	60	78	65	85
464	2.7	33	44	41	55	49	66	55	73	60	81	65	88
421	2.8	33	46	41	57	49	69	55	76	60	84	65	91
383	2.9	33	48	41	59	49	71	55	79	60	87	65	95
351	3.0	33	49	41	61	49	73	55	82	60	90	65	98
322	3.1	33	51	41	63	49	76	55	84	60	93	65	101
296	3.2	33	52	41	65	49	78	55	87	60	96	65	104
273	3.3	33	54	41	67	49	81	55	90	60	99	65	108
252	3.4	33	56	41	69	49	83	55	92	60	102	65	111
232	3.5	33	57	41	71	49	86	55	95	60	105	65	114
214	3.6	33	59	41	73	49	88	55	98	60	108	65	117
196	3.7	33	60	41	75	49	90	55	100	60	110	65	120
179	3.8	33	62	41	77	49	93	55	103	60	113	65	124
160	3.9	33	64	41	79	49	95	55	106	60	116	65	127
127	4.0	33	65	41	81	49	98	55	109	60	119	65	130

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

SPECIFICATION REFERENCE

TRANSITION CURVES - URBAN
20 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

TC-5.01		DESIGN FACTORS FOR A DESIGN SPEED OF 25 MPH (URBAN) USING E= 4% MAX.											
RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
2500	NC	0	0	0	0	0	0	0	0	0	0	0	0
1407	2.0	35	35	43	43	52	52	58	58	63	63	69	69
1299	2.1	35	36	43	45	52	54	58	60	63	66	69	72
1195	2.2	35	38	43	48	52	57	58	63	63	70	69	76
1094	2.3	35	40	43	50	52	60	58	66	63	73	69	79
990	2.4	35	42	43	52	52	62	58	69	63	76	69	83
883	2.5	35	43	43	54	52	65	58	72	63	79	69	86
793	2.6	35	45	43	56	52	67	58	75	63	82	69	90
718	2.7	35	47	43	58	52	70	58	78	63	85	69	93
654	2.8	35	48	43	60	52	72	58	80	63	88	69	96
598	2.9	35	50	43	63	52	75	58	83	63	92	69	100
548	3.0	35	52	43	65	52	78	58	86	63	95	69	103
505	3.1	35	54	43	67	52	80	58	89	63	98	69	107
466	3.2	35	55	43	69	52	83	58	92	63	101	69	110
430	3.3	35	57	43	71	52	85	58	95	63	104	69	114
397	3.4	35	59	43	73	52	88	58	98	63	107	69	117
367	3.5	35	60	43	75	52	90	58	100	63	110	69	120
339	3.6	35	62	43	78	52	93	58	103	63	114	69	124
311	3.7	35	64	43	80	52	96	58	106	63	117	69	127
284	3.8	35	66	43	82	52	98	58	109	63	120	69	131
255	3.9	35	67	43	84	52	101	58	112	63	123	69	134
204	4.0	35	69	43	86	52	103	58	115	63	126	69	138

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
25 MPH DESIGN SPEED
VIRGINIA DEPARTMENT OF TRANSPORTATION

DESIGN FACTORS FOR A DESIGN SPEED OF 30 MPH
(URBAN) USING E= 4% MAX.

TC-5.01

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
3000	NC	0	0	0	0	0	0	0	0	0	0	0	0
1940	2.0	37	37	46	46	55	55	61	61	67	67	73	73
1795	2.1	37	39	46	48	55	58	61	64	67	70	73	77
1658	2.2	37	40	46	50	55	60	61	67	67	74	73	80
1525	2.3	37	42	46	53	55	63	61	70	67	77	73	84
1393	2.4	37	44	46	55	55	66	61	73	67	80	73	88
1255	2.5	37	46	46	57	55	69	61	76	67	84	73	91
1134	2.6	37	48	46	60	55	71	61	79	67	87	73	95
1030	2.7	37	50	46	62	55	74	61	82	67	90	73	99
941	2.8	37	51	46	64	55	77	61	85	67	94	73	102
863	2.9	37	53	46	66	55	80	61	88	67	97	73	106
794	3.0	37	55	46	69	55	82	61	91	67	100	73	110
732	3.1	37	57	46	71	55	85	61	94	67	104	73	113
677	3.2	37	59	46	73	55	88	61	97	67	107	73	117
627	3.3	37	60	46	75	55	90	61	100	67	110	73	120
580	3.4	37	62	46	78	55	93	61	104	67	114	73	124
537	3.5	37	64	46	80	55	96	61	107	67	117	73	128
496	3.6	37	66	46	82	55	99	61	110	67	120	73	131
457	3.7	37	68	46	85	55	101	61	113	67	124	73	135
417	3.8	37	70	46	87	55	104	61	116	67	127	73	139
375	3.9	37	71	46	89	55	107	61	119	67	130	73	142
300	4.0	37	73	46	91	55	110	61	122	67	134	73	146

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN
72 FEET USE LS VALUES DEVELOPED BY
THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE
RADIUS FOR THE CORRESPONDING E, CR,
AND LS VALUES.

TRANSITION CURVES - URBAN
30 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

802.27

TC-5.01		DESIGN FACTORS FOR A DESIGN SPEED OF 35 MPH (URBAN) USING E= 4% MAX.											
RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
4000	NC	0	0	0	0	0	0	0	0	0	0	0	0
2561	2.0	39	39	49	49	59	59	65	65	71	71	78	78
2374	2.1	39	41	49	51	59	61	65	68	71	75	78	82
2199	2.2	39	43	49	54	59	64	65	71	71	79	78	86
2031	2.3	39	45	49	56	59	67	65	75	71	82	78	90
1866	2.4	39	47	49	59	59	70	65	78	71	86	78	93
1697	2.5	39	49	49	61	59	73	65	81	71	89	78	97
1538	2.6	39	51	49	63	59	76	65	84	71	93	78	101
1403	2.7	39	53	49	66	59	79	65	88	71	96	78	105
1285	2.8	39	55	49	68	59	82	65	91	71	100	78	109
1182	2.9	39	57	49	71	59	85	65	94	71	103	78	113
1090	3.0	39	59	49	73	59	88	65	97	71	107	78	117
1008	3.1	39	60	49	75	59	90	65	100	71	110	78	120
933	3.2	39	62	49	78	59	93	65	104	71	114	78	124
865	3.3	39	64	49	80	59	96	65	107	71	118	78	128
802	3.4	39	66	49	83	59	99	65	110	71	121	78	132
743	3.5	39	68	49	85	59	102	65	113	71	125	78	136
688	3.6	39	70	49	88	59	105	65	117	71	128	78	140
634	3.7	39	72	49	90	59	108	65	120	71	132	78	144
580	3.8	39	74	49	92	59	111	65	123	71	135	78	148
522	3.9	39	76	49	95	59	114	65	126	71	139	78	151
420	4.0	39	78	49	97	59	117	65	130	71	142	78	155

NOTE:
 CR AND LS VALUES IN FEET.
 FOR PAVEMENT WIDTHS GREATER THAN
 72 FEET USE LS VALUES DEVELOPED BY
 THE DESIGN SOFTWARE.
 LISTED RADIUS IS THE MINIMUM ALLOWABLE
 RADIUS FOR THE CORRESPONDING E, CR,
 AND LS VALUES.

TRANSITION CURVES - URBAN
 35 MPH DESIGN SPEED
 VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
 REFERENCE

DESIGN FACTORS FOR A DESIGN SPEED OF 40 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
5000	NC	0	0	0	0	0	0	0	0	0	0	0	0
3273	2.0	42	42	52	52	63	63	69	69	76	76	83	83
3039	2.1	42	44	52	55	63	66	69	73	76	80	83	87
2820	2.2	42	46	52	57	63	69	69	76	76	84	83	92
2612	2.3	42	48	52	60	63	72	69	80	76	88	83	96
2411	2.4	42	50	52	63	63	75	69	83	76	92	83	100
2209	2.5	42	52	52	65	63	78	69	87	76	95	83	104
2010	2.6	42	54	52	68	63	81	69	90	76	99	83	108
1839	2.7	42	56	52	70	63	84	69	94	76	103	83	112
1689	2.8	42	58	52	73	63	87	69	97	76	107	83	116
1557	2.9	42	60	52	75	63	90	69	100	76	110	83	120
1439	3.0	42	63	52	78	63	94	69	104	76	114	83	125
1332	3.1	42	65	52	81	63	97	69	107	76	118	83	129
1236	3.2	42	67	52	83	63	100	69	111	76	122	83	133
1148	3.3	42	69	52	86	63	103	69	114	76	126	83	137
1066	3.4	42	71	52	88	63	106	69	118	76	129	83	141
989	3.5	42	73	52	91	63	109	69	121	76	133	83	145
916	3.6	42	75	52	94	63	112	69	125	76	137	83	149
845	3.7	42	77	52	96	63	115	69	128	76	141	83	154
774	3.8	42	79	52	99	63	118	69	132	76	145	83	158
698	3.9	42	81	52	101	63	122	69	135	76	148	83	162
563	4.0	42	83	52	104	63	125	69	138	76	152	83	166

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
40 MPH DESIGN SPEED

DESIGN FACTORS FOR A DESIGN SPEED OF 45 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
6000	NC	0	0	0	0	0	0	0	0	0	0	0	0
4076	2.0	45	45	56	56	67	67	75	75	82	82	89	89
3790	2.1	45	47	56	59	67	70	75	78	82	86	89	94
3523	2.2	45	49	56	62	67	74	75	82	82	90	89	98
3271	2.3	45	52	56	64	67	77	75	86	82	94	89	103
3029	2.4	45	54	56	67	67	80	75	89	82	98	89	107
2790	2.5	45	56	56	70	67	84	75	93	82	102	89	112
2552	2.6	45	58	56	73	67	87	75	97	82	106	89	116
2341	2.7	45	60	56	75	67	90	75	100	82	110	89	120
2155	2.8	45	63	56	78	67	94	75	104	82	115	89	125
1990	2.9	45	65	56	81	67	97	75	108	82	119	89	129
1843	3.0	45	67	56	84	67	100	75	112	82	123	89	134
1710	3.1	45	69	56	87	67	104	75	115	82	127	89	138
1589	3.2	45	72	56	89	67	107	75	119	82	131	89	143
1477	3.3	45	74	56	92	67	110	75	123	82	135	89	147
1374	3.4	45	76	56	95	67	114	75	126	82	139	89	152
1276	3.5	45	78	56	98	67	117	75	130	82	143	89	156
1184	3.6	45	80	56	100	67	120	75	134	82	147	89	160
1093	3.7	45	83	56	103	67	124	75	138	82	151	89	165
1003	3.8	45	85	56	106	67	127	75	141	82	155	89	169
905	3.9	45	87	56	109	67	130	75	145	82	159	89	174
730	4.0	45	89	56	112	67	134	75	149	82	163	89	178

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
45 MPH DESIGN SPEED

DESIGN FACTORS FOR A DESIGN SPEED OF 50 MPH
(URBAN) USING E= 4 % MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
8000	NC	0	0	0	0	0	0	0	0	0	0	0	0
4792	2.0	48	48	60	60	72	72	80	80	88	88	96	96
4629	2.1	48	51	60	63	72	76	80	84	88	93	96	101
4310	2.2	48	53	60	66	72	80	80	88	88	97	96	106
4010	2.3	48	56	60	69	72	83	80	92	88	102	96	111
3723	2.4	48	58	60	72	72	87	80	96	88	106	96	116
3444	2.5	48	60	60	75	72	90	80	100	88	110	96	120
3166	2.6	48	63	60	78	72	94	80	104	88	115	96	125
2911	2.7	48	65	60	81	72	98	80	108	88	119	96	130
2686	2.8	48	68	60	84	72	101	80	112	88	124	96	135
2486	2.9	48	70	60	87	72	105	80	116	88	128	96	140
2306	3.0	48	72	60	90	72	108	80	120	88	132	96	144
2143	3.1	48	75	60	93	72	112	80	124	88	137	96	149
1994	3.2	48	77	60	96	72	116	80	128	88	141	96	154
1857	3.3	48	80	60	99	72	119	80	132	88	146	96	159
1729	3.4	48	82	60	102	72	123	80	136	88	150	96	164
1608	3.5	48	84	60	105	72	126	80	140	88	154	96	168
1493	3.6	48	87	60	108	72	130	80	144	88	159	96	173
1381	3.7	48	89	60	111	72	134	80	148	88	163	96	178
1268	3.8	48	92	60	114	72	137	80	152	88	168	96	183
1146	3.9	48	94	60	117	72	141	80	156	88	172	96	188
929	4.0	48	96	60	120	72	144	80	160	88	176	96	192

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR AND LS VALUES.

TRANSITION CURVES - URBAN
50 MPH DESIGN SPEED

DESIGN FACTORS FOR A DESIGN SPEED OF 55 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
10000	NC	0	0	0	0	0	0	0	0	0	0	0	0
5995	2.0	52	52	64	64	77	77	86	86	94	94	103	103
5592	2.1	52	54	64	68	77	81	86	90	94	99	103	108
5218	2.2	52	57	64	71	77	85	86	94	94	103	103	113
4869	2.3	52	59	64	74	77	89	86	98	94	108	103	118
4538	2.4	52	62	64	77	77	92	86	103	94	113	103	123
4220	2.5	52	64	64	80	77	96	86	107	94	118	103	128
3909	2.6	52	67	64	83	77	100	86	111	94	122	103	133
3610	2.7	52	69	64	87	77	104	86	115	94	127	103	138
3343	2.8	52	72	64	90	77	108	86	120	94	132	103	143
3104	2.9	52	75	64	93	77	112	86	124	94	136	103	149
2888	3.0	52	77	64	96	77	115	86	128	94	141	103	154
2691	3.1	52	80	64	99	77	119	86	132	94	146	103	159
2510	3.2	52	82	64	103	77	123	86	137	94	150	103	164
2343	3.3	52	85	64	106	77	127	86	141	94	155	103	169
2186	3.4	52	87	64	109	77	131	86	145	94	160	103	174
2037	3.5	52	90	64	112	77	135	86	149	94	164	103	179
1895	3.6	52	92	64	115	77	138	86	154	94	169	103	184
1756	3.7	52	95	64	119	77	142	86	158	94	174	103	189
1615	3.8	52	98	64	122	77	146	86	162	94	178	103	195
1462	3.9	52	100	64	125	77	150	86	166	94	183	103	200
1190	4.0	52	103	64	128	77	154	86	171	94	188	103	205

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
55 MPH DESIGN SPEED

DESIGN FACTORS FOR A DESIGN SPEED OF 60 MPH
(URBAN) USING E= 4 % MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH												
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT		
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'		
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	
10000	NC	0	0	0	0	0	0	0	0	0	0	0	0	0
7131	2.0	54	54	67	67	80	80	89	89	98	98	107	107	107
6663	2.1	54	56	67	70	80	84	89	94	98	103	107	112	112
6232	2.2	54	59	67	74	80	88	89	98	98	108	107	118	118
5829	2.3	54	62	67	77	80	92	89	103	98	113	107	123	123
5451	2.4	54	64	67	80	80	96	89	107	98	118	107	128	128
5092	2.5	54	67	67	84	80	100	89	112	98	123	107	134	134
4746	2.6	54	70	67	87	80	104	89	116	98	128	107	139	139
4408	2.7	54	72	67	90	80	108	89	120	98	132	107	144	144
4098	2.8	54	75	67	94	80	112	89	125	98	137	107	150	150
3818	2.9	54	78	67	97	80	116	89	129	98	142	107	155	155
3563	3.0	54	80	67	100	80	120	89	134	98	147	107	160	160
3330	3.1	54	83	67	104	80	124	89	138	98	152	107	166	166
3114	3.2	54	86	67	107	80	128	89	143	98	157	107	171	171
2913	3.3	54	88	67	110	80	132	89	147	98	162	107	176	176
2724	3.4	54	91	67	114	80	136	89	152	98	167	107	182	182
2544	3.5	54	94	67	117	80	140	89	156	98	172	107	187	187
2372	3.6	54	96	67	120	80	144	89	160	98	176	107	192	192
2202	3.7	54	99	67	124	80	148	89	165	98	181	107	198	198
2030	3.8	54	102	67	127	80	152	89	169	98	186	107	203	203
1842	3.9	54	104	67	130	80	156	89	174	98	191	107	208	208
1505	4.0	54	107	67	134	80	160	89	178	98	196	107	214	214

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
60 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

DESIGN FACTORS FOR A DESIGN SPEED OF 25 MPH (RURAL) USING E = 8% MAX.

DESIGN VELOCITY -25	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS										
	WIDTH+ 18 FT			WIDTH+20 FT			WIDTH+22 FT			WIDTH+24 FT			WIDTH+48 FT			WIDTH							
	1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			16 FT		18 FT					
RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	CR	LS	CR	LS	
2500	NC	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0	0	0	0	0
1756	2.0	26	26	0.0	29	29	0.0	32	32	0.0	35	35	0.0	35	35	0.0	52	52	0.0	40	40	43	43
1664	2.1	77	80	2.0	29	30	0.0	32	33	0.0	35	36	0.0	52	54	0.0	40	42	0.0	40	42	43	45
1579	2.2	73	80	2.0	29	32	0.0	32	35	0.0	35	38	0.0	52	57	0.0	40	44	0.0	40	44	43	48
1502	2.3	70	80	2.0	29	33	0.0	33	37	0.0	35	40	0.0	52	60	0.0	40	46	0.0	40	46	43	50
1431	2.4	67	80	2.1	29	35	0.0	32	38	0.0	35	42	0.0	52	62	0.0	40	48	0.0	40	48	43	52
1366	2.5	64	80	2.1	29	36	0.0	32	40	0.0	35	43	0.0	52	65	0.0	40	50	0.0	40	50	43	54
1306	2.6	62	80	2.1	29	38	0.0	32	41	0.0	35	45	0.0	52	67	0.0	40	52	0.0	40	52	43	56
1250	2.7	60	80	2.1	29	39	0.0	32	43	0.0	35	47	0.0	52	70	0.0	40	54	0.0	40	54	43	58
1198	2.8	58	80	2.2	29	40	0.0	32	44	0.0	35	48	0.0	52	72	0.0	40	56	0.0	40	56	43	60
1149	2.9	56	80	2.2	29	42	0.0	32	46	0.0	35	50	0.0	52	75	0.0	40	58	0.0	40	58	43	63
1104	3.0	54	80	2.2	29	43	0.0	32	48	0.0	35	52	0.0	52	78	0.0	40	60	0.0	40	60	43	65
1061	3.1	52	80	2.3	29	45	0.0	32	49	0.0	35	54	0.0	52	80	0.0	40	62	0.0	40	62	43	67
1021	3.2	50	80	2.3	29	46	0.0	32	51	0.0	35	55	0.0	52	83	0.0	40	64	0.0	40	64	43	69
983	3.3	49	80	2.3	29	48	0.0	32	52	0.0	35	57	0.0	52	85	0.0	40	66	0.0	40	66	43	71
948	3.4	48	80	2.4	29	49	0.0	32	54	0.0	35	59	0.0	52	88	0.0	40	68	0.0	40	68	43	73
914	3.5	46	80	2.4	29	50	0.0	32	55	0.0	35	60	0.0	52	90	0.0	40	70	0.0	40	70	43	75
882	3.6	45	80	2.4	29	52	0.0	32	57	0.0	35	62	0.0	52	93	0.0	40	72	0.0	40	72	43	78
852	3.7	44	80	2.5	29	53	0.0	32	59	0.0	35	64	0.0	52	96	0.0	40	74	0.0	40	74	43	80
823	3.8	43	80	2.5	29	55	0.0	32	60	0.0	35	66	0.0	52	98	0.0	40	76	0.0	40	76	43	82
795	3.9	42	80	2.6	29	56	0.0	32	62	0.0	35	67	0.0	52	101	0.0	40	78	0.0	40	78	43	84
769	4.0	40	80	2.6	29	58	0.0	32	63	0.0	35	69	0.0	52	103	0.0	40	80	0.0	40	80	43	86
744	4.1	40	80	2.6	29	59	0.0	32	65	0.0	35	71	0.0	52	106	0.0	40	82	0.0	40	82	43	88
720	4.2	39	80	2.7	29	60	0.0	32	66	0.0	35	72	0.0	52	108	0.0	40	84	0.0	40	84	43	90
696	4.3	38	80	2.7	29	62	0.0	32	68	0.0	35	74	0.0	52	111	0.0	40	86	0.0	40	86	43	93
674	4.4	37	80	2.7	29	63	0.0	32	70	0.0	35	76	0.0	52	114	0.0	40	88	0.0	40	88	43	95
652	4.5	36	80	2.8	29	65	0.0	32	71	0.0	35	78	0.0	52	116	0.0	40	90	0.0	40	90	43	97
632	4.6	35	80	2.8	29	66	0.0	32	73	0.0	35	79	0.0	52	119	0.0	40	92	0.0	40	92	43	99
612	4.7	35	80	2.9	29	68	0.0	32	74	0.0	35	81	0.0	52	121	0.0	40	94	0.0	40	94	43	101
592	4.8	34	80	2.9	29	69	0.0	32	76	0.0	35	83	0.0	52	124	0.0	40	96	0.0	40	96	43	103
573	4.9	33	80	2.9	29	70	0.0	32	77	0.0	35	84	0.0	52	126	0.0	40	98	0.0	40	98	43	105
555	5.0	32	80	3.0	32	80	2.0	32	79	0.0	35	86	0.0	52	129	0.0	40	100	0.0	40	100	43	108
537	5.1	32	80	3.0	32	81	2.0	32	81	0.0	35	88	0.0	52	132	0.0	40	102	0.0	40	102	43	110
519	5.2	31	80	3.1	32	83	2.1	32	82	0.0	35	90	0.0	52	134	0.0	40	104	0.0	40	104	43	112
502	5.3	31	80	3.1	32	84	2.1	32	84	0.0	35	91	0.0	52	137	0.0	40	106	0.0	40	106	43	114
485	5.4	31	82	3.2	32	86	2.2	32	85	0.0	35	93	0.0	52	139	0.0	40	108	0.0	40	108	43	116
468	5.5	31	84	3.2	32	88	2.2	32	87	0.0	35	95	0.0	52	142	0.0	40	110	0.0	40	110	43	118
452	5.6	31	86	3.3	33	90	2.3	32	88	0.0	35	96	0.0	52	144	0.0	40	112	0.0	40	112	43	120
437	5.7	31	88	3.4	33	92	2.4	32	90	0.0	35	98	0.0	52	147	0.0	40	114	0.0	40	114	43	123
423	5.8	31	89	3.4	33	93	2.4	32	92	0.0	35	100	0.0	52	150	0.0	40	116	0.0	40	116	43	125
409	5.9	31	91	3.5	33	95	2.5	32	93	0.0	35	102	0.0	52	152	0.0	40	118	0.0	40	118	43	127
396	6.0	31	93	3.5	33	97	2.5	32	95	0.0	35	103	0.0	52	155	0.0	40	120	0.0	40	120	43	129
383	6.1	32	95	3.6	33	99	2.6	32	96	0.0	35	105	0.0	52	157	0.0	40	122	0.0	40	122	43	131
371	6.2	32	97	3.7	33	101	2.7	32	98	0.0	35	107	0.0	52	160	0.0	40	124	0.0	40	124	43	133
359	6.3	32	98	3.7	33	103	2.7	32	99	0.0	35	108	0.0	52	162	0.0	40	126	0.0	40	126	43	135
347	6.4	32	100	3.8	33	105	2.8	32	101	0.0	35	110	0.0	52	165	0.0	40	128	0.0	40	128	43	138
336	6.5	32	102	3.9	33	103	2.9	32	103	0.0	35	112	0.0	52	168	0.0	40	130	0.0	40	130	43	140
326	6.6	32	104	3.9	33	108	2.9	32	104	0.0	35	114	0.0	52	170	0.0	40	132	0.0	40	132	43	142
315	6.7	32	106	4.0	34	111	3.0	35	115	2.0	35	115	0.0	56	187	2.0	40	134	0.0	40	134	43	144
305	6.8	32	108	4.1	34	113	3.1	35	118	2.1	35	117	0.0	57	191	2.2	40	136	0.0	40	136	43	146
295	6.9	32	110	4.2	34	115	3.2	35	120	2.2	35	119	0.0	57	196	2.4	40	138	0.0	40	138	43	148
286	7.0	32	111	4.2	34	116	3.2	35	121	2.2	35	120	0.0	57	198	2.4	40	140	0.0	40	140	43	150
276	7.1	33	114	4.3	34	119	3.3	35	124	2.3	35	122	0.0	58	203	2.6	40	142	0.0	40	142	43	153
267	7.2	33	116	4.4	34	121	3.4	35	126	2.4	35	124	0.0	58	207	2.8	40	144	0.0	40	144	43	155
258	7.3	33	118	4.5	34	123	3.5	36	128	2.5	35	126	0.0	59	212	3.0	40	146	0.0	40	146	43	157
248	7.4	33	120	4.6	34	125	3.6	36	131	2.6	35	127	0.0	59	216	3.2	40	148	0.0	40	148	43	159
239	7.5	33	122	4.7	34	127	3.7	36	133	2.7	35	129	0.0	59	221	3.4	40	150	0.0	40	150	43	161
229	7.6	33	124	4.8	35	130	3.8	36	135	2.8	35	131	0.0	60	225	3.6	40	152	0.0	40	152	43	163
219	7.7	33	127	5.0	35	132	4.0	36	138	3.0	38	143	2.0	60	231	4.0	40	154	0.0	40	154	43	165
209	7.8	34	129	5.1	35	135	4.1	36	140	3.1	38	146	2.1	61	236	4.2	40	156	0.0	40	156	43	168
196	7.9	34	132	5.3	35	138	4.3	37	143	3.3	38	149	2.3	62	243	4.6	40	158	0.0	40	158	43	170
172	8.0	34	136	5.8	36	142	4.8	37	148	3.8	39	154	2.8	64	254	5.6	40	160	0.0	40	160	43	172

NOTE: CR, LS & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.

TRANSITION CURVES - RURAL
25 MPH DESIGN SPEED

DESIGN FACTORS FOR A DESIGN SPEED OF 35 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY -35	WIDTH= 18 FT		WIDTH=20 FT		WIDTH=22 FT		WIDTH=24 FT		WIDTH=24 FT		WIDTH=48 FT		WIDTH=72 FT		INTERCHANGE RAMP								
	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						WIDTH										
	1 @ 9'		1 @ 10'		1 @ 11'		1 @ 12'		1 @ 12'		2 @ 12'		3 @ 12'		16 FT		18 FT						
RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	CR	LS	CR	LS	
5000	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3149	2.0	30	0.0	33	3.3	0.0	36	3.6	0.0	39	3.9	0.0	59	5.9	0.0	78	7.8	0.0	46	4.6	48	4.8	
2866	2.1	30	0.0	33	3.4	0.0	36	3.8	0.0	39	4.1	0.0	59	6.1	0.0	78	8.2	0.0	46	4.8	48	5.1	
2865	2.2	30	0.0	33	3.6	0.0	36	4.0	0.0	39	4.3	0.0	59	6.4	0.0	78	8.6	0.0	46	5.0	48	5.3	
2835	2.2	30	0.0	33	3.6	0.0	36	4.0	0.0	39	4.3	0.0	59	6.4	0.0	78	8.6	0.0	46	5.0	48	5.3	
2698	2.3	30	0.0	33	3.8	0.0	36	4.1	0.0	39	4.5	0.0	59	6.7	0.0	78	9.0	0.0	46	5.2	48	5.6	
2573	2.4	30	0.0	33	3.9	0.0	36	4.3	0.0	39	4.7	0.0	59	7.0	0.0	78	9.3	0.0	46	5.5	48	5.8	
2457	2.5	96	120	2.0	33	4.1	0.0	36	4.5	0.0	39	4.9	0.0	59	7.3	0.0	78	9.7	0.0	46	5.7	48	6.0
2350	2.6	93	120	2.0	33	4.2	0.0	36	4.7	0.0	39	5.1	0.0	59	7.6	0.0	78	10.1	0.0	46	5.9	48	6.3
2159	2.8	86	120	2.0	33	4.6	0.0	36	5.0	0.0	39	5.5	0.0	59	8.2	0.0	78	10.9	0.0	46	6.4	48	6.8
2073	2.9	83	120	2.1	33	4.7	0.0	36	5.2	0.0	39	5.7	0.0	59	8.5	0.0	78	11.3	0.0	46	6.6	48	7.0
1993	3.0	80	120	2.1	33	4.9	0.0	36	5.4	0.0	39	5.9	0.0	59	8.8	0.0	78	11.7	0.0	46	6.8	48	7.2
1917	3.1	78	120	2.1	33	5.0	0.0	36	5.5	0.0	39	6.0	0.0	59	9.0	0.0	78	12.0	0.0	46	7.0	48	7.5
1847	3.2	75	120	2.1	33	5.2	0.0	36	5.7	0.0	39	6.2	0.0	59	9.3	0.0	78	12.4	0.0	46	7.3	48	7.7
1780	3.3	73	120	2.2	33	5.4	0.0	36	5.9	0.0	39	6.4	0.0	59	9.6	0.0	78	12.8	0.0	46	7.5	48	8.0
1717	3.4	71	120	2.2	33	5.5	0.0	36	6.1	0.0	39	6.6	0.0	59	9.9	0.0	78	13.2	0.0	46	7.7	48	8.2
1658	3.5	69	120	2.2	33	5.7	0.0	36	6.3	0.0	39	6.8	0.0	59	10.2	0.0	78	13.6	0.0	46	7.9	48	8.4
1602	3.6	67	120	2.2	33	5.9	0.0	36	6.4	0.0	39	7.0	0.0	59	10.5	0.0	78	14.0	0.0	46	8.2	48	8.7
1548	3.7	65	120	2.3	33	6.0	0.0	36	6.6	0.0	39	7.2	0.0	59	10.8	0.0	78	14.4	0.0	46	8.4	48	8.9
1497	3.8	64	120	2.3	33	6.2	0.0	36	6.8	0.0	39	7.4	0.0	59	11.1	0.0	78	14.8	0.0	46	8.6	48	9.2
1449	3.9	62	120	2.3	33	6.3	0.0	36	7.0	0.0	39	7.6	0.0	59	11.4	0.0	78	15.1	0.0	46	8.8	48	9.4
1403	4.0	60	120	2.3	33	6.5	0.0	36	7.1	0.0	39	7.8	0.0	59	11.7	0.0	78	15.5	0.0	46	9.1	48	9.6
1359	4.1	59	120	2.4	33	6.7	0.0	36	7.3	0.0	39	8.0	0.0	59	12.0	0.0	78	15.9	0.0	46	9.3	48	9.9
1317	4.2	58	120	2.4	33	6.8	0.0	36	7.5	0.0	39	8.2	0.0	59	12.2	0.0	78	16.3	0.0	46	9.5	48	10.1
1277	4.3	56	120	2.4	33	7.0	0.0	36	7.7	0.0	39	8.4	0.0	59	12.5	0.0	78	16.7	0.0	46	9.7	48	10.4
1238	4.4	55	120	2.4	33	7.1	0.0	36	7.9	0.0	39	8.6	0.0	59	12.8	0.0	78	17.1	0.0	46	10.0	48	10.6
1201	4.5	54	120	2.5	33	7.3	0.0	36	8.0	0.0	39	8.8	0.0	59	13.1	0.0	78	17.5	0.0	46	10.2	48	10.8
1165	4.6	53	120	2.5	33	7.5	0.0	36	8.2	0.0	39	9.0	0.0	59	13.4	0.0	78	17.9	0.0	46	10.4	48	11.1
1131	4.7	52	120	2.5	33	7.6	0.0	36	8.4	0.0	39	9.1	0.0	59	13.7	0.0	78	18.2	0.0	46	10.6	48	11.3
1097	4.8	50	120	2.6	33	7.8	0.0	36	8.6	0.0	39	9.3	0.0	59	14.0	0.0	78	18.6	0.0	46	10.9	48	11.6
1065	4.9	49	120	2.6	33	8.0	0.0	36	8.7	0.0	39	9.5	0.0	59	14.3	0.0	78	19.0	0.0	46	11.1	48	11.8
1034	5.0	48	120	2.6	33	8.1	0.0	36	8.9	0.0	39	9.7	0.0	59	14.6	0.0	78	19.4	0.0	46	11.3	48	12.0
1004	5.1	48	120	2.6	33	8.3	0.0	36	9.1	0.0	39	9.9	0.0	59	14.9	0.0	78	19.8	0.0	46	11.5	48	12.3
975	5.2	47	120	2.7	33	8.4	0.0	36	9.3	0.0	39	10.1	0.0	59	15.1	0.0	78	20.2	0.0	46	11.8	48	12.5
946	5.3	46	120	2.7	33	8.6	0.0	36	9.5	0.0	39	10.3	0.0	59	15.4	0.0	78	20.6	0.0	46	12.0	48	12.8
918	5.4	45	120	2.7	33	8.8	0.0	36	9.6	0.0	39	10.5	0.0	59	15.7	0.0	78	21.0	0.0	46	12.2	48	13.0
891	5.5	44	120	2.8	33	8.9	0.0	36	9.8	0.0	39	10.7	0.0	59	16.0	0.0	78	21.3	0.0	46	12.4	48	13.2
864	5.6	43	120	2.8	33	9.1	0.0	36	10.0	0.0	39	10.9	0.0	59	16.3	0.0	78	21.7	0.0	46	12.7	48	13.5
838	5.7	43	120	2.8	33	9.2	0.0	36	10.2	0.0	39	11.1	0.0	59	16.6	0.0	78	22.1	0.0	46	12.9	48	13.7
813	5.8	42	120	2.9	33	9.4	0.0	36	10.3	0.0	39	11.3	0.0	59	16.9	0.0	78	22.5	0.0	46	13.1	48	14.0
789	5.9	41	120	2.9	33	9.6	0.0	36	10.5	0.0	39	11.5	0.0	59	17.2	0.0	78	22.9	0.0	46	13.3	48	14.2
766	6.0	40	120	3.0	40	120	2.0	36	10.7	0.0	39	11.7	0.0	59	17.5	0.0	78	23.3	0.0	46	13.6	48	14.4
743	6.1	40	120	3.0	40	120	2.0	36	10.9	0.0	39	11.9	0.0	59	17.8	0.0	78	23.7	0.0	46	13.8	48	14.7
722	6.2	39	120	3.0	39	120	2.0	36	11.0	0.0	39	12.0	0.0	59	18.0	0.0	78	24.0	0.0	46	14.0	48	14.9
701	6.3	39	120	3.1	39	120	2.1	36	11.2	0.0	39	12.2	0.0	59	18.3	0.0	78	24.4	0.0	46	14.2	48	15.2
680	6.4	38	120	3.1	38	120	2.1	36	11.4	0.0	39	12.4	0.0	59	18.6	0.0	78	24.8	0.0	46	14.5	48	15.4
660	6.5	37	120	3.2	37	120	2.2	36	11.6	0.0	39	12.6	0.0	59	18.9	0.0	78	25.2	0.0	46	14.7	48	15.6
641	6.6	37	120	3.2	37	120	2.2	36	11.8	0.0	39	12.8	0.0	59	19.2	0.0	78	25.6	0.0	46	14.9	48	15.9
622	6.7	36	120	3.2	36	120	2.2	36	11.9	0.0	39	13.0	0.0	59	19.5	0.0	78	26.0	0.0	46	15.1	48	16.1
603	6.8	36	120	3.3	37	123	2.3	36	12.1	0.0	39	13.2	0.0	59	19.8	0.0	78	26.4	0.0	46	15.4	48	16.4
585	6.9	35	120	3.3	37	125	2.3	36	12.3	0.0	39	13.4	0.0	59	20.1	0.0	78	26.8	0.0	46	15.6	48	16.6
567	7.0	35	121	3.4	37	127	2.4	36	12.5	0.0	39	13.6	0.0	59	20.4	0.0	78	27.1	0.0	46	15.8	48	16.8
550	7.1	35	123	3.4	37	129	2.4	36	12.6	0.0	39	13.8	0.0	59	20.7	0.0	78	27.5	0.0	46	16.0	48	17.1
532	7.2	35	125	3.5	37	131	2.5	36	12.8	0.0	39	14.0	0.0	59	21.0	0.0	78	27.9	0.0	46	16.3	48	17.3
515	7.3	35	127	3.5	37	133	2.5	36	13.0	0.0	39	14.2	0.0	59	21.2	0.0	78	28.3	0.0	46	16.5	48	17.6
497	7.4	35	129	3.6	37	135	2.6	36	13.2	0.0	39	14.4	0.0	59	21.5	0.0	78	28.7	0.0	46	16.7	48	17.8
480	7.5	35	132	3.7	37	138	2.7	36	13.4	0.0	39	14.6	0.0	59	21.8	0.0	83	30.8	2.1	46	17.0	48	18.0
461	7.6	35	133	3.7	37	140	2.7	36	13.5	0.0	39	14.8	0.0	59	22.1	0.0	83	31.2	2.1	46	17.2	48	18.3
442	7.7	36	136	3.8	37	142	2.8	36	13.7	0.0	39	15.0	0.0	59	22.4	0.0	83	31.8	2.4	46	17.4	48	18.5
422	7.8	36	138	3.9	38	145	2.9	36	13.9	0.0	39	15.1	0.0	59	22.7	0.0	84	32.5	2.7	46	17.6	48	18.8
397	7.9	36	141	4.0	38	147	3.0	39	15.3	0.0	39	15.3	0.0	64	24.9	2.0	85	33.2	3.0	46	17.9	48	19.0
350	8.0	36	144	4.3	38	151	3.3	40	15.7	2													

DESIGN VELOCITY =45		DESIGN FACTORS FOR A DESIGN SPEED OF 45 MPH (RURAL) USING E = 8% MAX.																							
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						INTERCHANGE RAMPS																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'			16 FT			18 FT		
		CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
8000	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
4957	2.0	34	34	0.0	38	38	0.0	41	41	0.0	45	45	0.0	47	47	0.0	67	67	0.0	89	89	0.0	53	53	
4702	2.1	34	35	0.0	38	39	0.0	41	43	0.0	45	47	0.0	67	70	0.0	89	94	0.0	89	94	0.0	53	56	
4467	2.2	34	37	0.0	38	41	0.0	41	45	0.0	45	49	0.0	67	74	0.0	89	98	0.0	89	98	0.0	53	58	
4254	2.3	34	39	0.0	38	43	0.0	41	47	0.0	45	52	0.0	67	77	0.0	89	103	0.0	89	103	0.0	53	61	
4057	2.4	34	40	0.0	38	45	0.0	41	49	0.0	45	54	0.0	67	80	0.0	89	107	0.0	89	107	0.0	53	63	
3876	2.5	34	42	0.0	38	47	0.0	41	51	0.0	45	56	0.0	67	84	0.0	89	112	0.0	89	112	0.0	53	66	
3710	2.6	34	44	0.0	38	49	0.0	41	53	0.0	45	58	0.0	67	87	0.0	89	116	0.0	89	116	0.0	53	69	
3554	2.7	34	45	0.0	38	50	0.0	41	55	0.0	45	60	0.0	67	90	0.0	89	120	0.0	89	120	0.0	53	71	
3412	2.8	34	47	0.0	38	52	0.0	41	58	0.0	45	63	0.0	67	94	0.0	89	125	0.0	89	125	0.0	53	74	
3278	2.9	34	49	0.0	38	54	0.0	41	60	0.0	45	65	0.0	67	97	0.0	89	129	0.0	89	129	0.0	53	77	
3152	3.0	34	50	0.0	38	56	0.0	41	62	0.0	45	67	0.0	67	100	0.0	89	134	0.0	89	134	0.0	53	79	
3035	3.1	34	52	0.0	38	58	0.0	41	64	0.0	45	69	0.0	67	104	0.0	89	138	0.0	89	138	0.0	53	82	
2925	3.2	34	54	0.0	38	60	0.0	41	66	0.0	45	72	0.0	67	107	0.0	89	143	0.0	89	143	0.0	53	84	
2866	3.3	34	55	0.0	38	62	0.0	41	68	0.0	45	74	0.0	67	110	0.0	89	147	0.0	89	147	0.0	53	87	
2865	3.3	85	140	2.1	38	62	0.0	41	68	0.0	45	74	0.0	67	110	0.0	89	147	0.0	89	147	0.0	53	87	
2822	3.3	85	140	2.1	38	62	0.0	41	68	0.0	45	74	0.0	67	110	0.0	89	147	0.0	89	147	0.0	53	87	
2724	3.4	83	140	2.1	38	65	0.0	41	70	0.0	45	76	0.0	67	114	0.0	89	152	0.0	89	152	0.0	53	90	
2631	3.5	80	140	2.1	38	65	0.0	41	72	0.0	45	78	0.0	67	117	0.0	89	156	0.0	89	156	0.0	53	92	
2544	3.6	78	140	2.1	38	67	0.0	41	74	0.0	45	80	0.0	67	120	0.0	89	160	0.0	89	160	0.0	53	95	
2461	3.7	76	140	2.2	38	69	0.0	41	76	0.0	45	83	0.0	67	124	0.0	89	165	0.0	89	165	0.0	53	98	
2363	3.8	74	140	2.2	38	71	0.0	41	78	0.0	45	85	0.0	67	127	0.0	89	169	0.0	89	169	0.0	53	100	
2308	3.9	72	140	2.2	38	73	0.0	41	80	0.0	45	87	0.0	67	130	0.0	89	174	0.0	89	174	0.0	53	103	
2237	4.0	70	140	2.2	38	75	0.0	41	82	0.0	45	89	0.0	67	134	0.0	89	178	0.0	89	178	0.0	53	105	
2169	4.1	69	140	2.2	38	76	0.0	41	84	0.0	45	92	0.0	67	137	0.0	89	183	0.0	89	183	0.0	53	108	
2104	4.2	67	140	2.3	38	78	0.0	41	86	0.0	45	94	0.0	67	140	0.0	89	187	0.0	89	187	0.0	53	111	
2041	4.3	66	140	2.3	38	80	0.0	41	88	0.0	45	96	0.0	67	144	0.0	89	192	0.0	89	192	0.0	53	113	
1982	4.4	64	140	2.3	38	82	0.0	41	90	0.0	45	98	0.0	67	147	0.0	89	196	0.0	89	196	0.0	53	116	
1924	4.5	63	140	2.3	38	84	0.0	41	92	0.0	45	100	0.0	67	150	0.0	89	200	0.0	89	200	0.0	53	119	
1870	4.6	61	140	2.4	38	86	0.0	41	94	0.0	45	103	0.0	67	154	0.0	89	205	0.0	89	205	0.0	53	121	
1817	4.7	60	140	2.4	38	88	0.0	41	96	0.0	45	105	0.0	67	157	0.0	89	209	0.0	89	209	0.0	53	124	
1766	4.8	59	140	2.4	38	89	0.0	41	98	0.0	45	107	0.0	67	160	0.0	89	214	0.0	89	214	0.0	53	126	
1717	4.9	58	140	2.4	38	91	0.0	41	100	0.0	45	109	0.0	67	164	0.0	89	218	0.0	89	218	0.0	53	129	
1669	5.0	56	140	2.4	38	93	0.0	41	102	0.0	45	112	0.0	67	167	0.0	89	223	0.0	89	223	0.0	53	132	
1624	5.1	55	140	2.5	38	95	0.0	41	104	0.0	45	114	0.0	67	170	0.0	89	227	0.0	89	227	0.0	53	134	
1579	5.2	54	140	2.5	38	97	0.0	41	106	0.0	45	116	0.0	67	174	0.0	89	232	0.0	89	232	0.0	53	137	
1536	5.3	53	140	2.5	38	99	0.0	41	108	0.0	45	118	0.0	67	177	0.0	89	236	0.0	89	236	0.0	53	140	
1495	5.4	52	140	2.5	38	100	0.0	41	110	0.0	45	120	0.0	67	180	0.0	89	240	0.0	89	240	0.0	53	142	
1454	5.5	51	140	2.6	38	102	0.0	41	113	0.0	45	123	0.0	67	184	0.0	89	245	0.0	89	245	0.0	53	145	
1415	5.6	50	140	2.6	38	104	0.0	41	115	0.0	45	125	0.0	67	187	0.0	89	249	0.0	89	249	0.0	53	147	
1376	5.7	50	140	2.6	38	106	0.0	41	117	0.0	45	127	0.0	67	190	0.0	89	254	0.0	89	254	0.0	53	150	
1339	5.8	49	140	2.6	38	108	0.0	41	119	0.0	45	129	0.0	67	194	0.0	89	258	0.0	89	258	0.0	53	153	
1302	5.9	48	140	2.7	38	110	0.0	41	121	0.0	45	132	0.0	67	197	0.0	89	263	0.0	89	263	0.0	53	155	
1266	6.0	47	140	2.7	38	112	0.0	41	123	0.0	45	134	0.0	67	200	0.0	89	267	0.0	89	267	0.0	53	158	
1232	6.1	46	140	2.7	38	113	0.0	41	125	0.0	45	136	0.0	67	204	0.0	89	272	0.0	89	272	0.0	53	160	
1199	6.2	46	140	2.8	38	115	0.0	41	127	0.0	45	138	0.0	67	207	0.0	89	276	0.0	89	276	0.0	53	163	
1166	6.3	45	140	2.8	38	117	0.0	41	129	0.0	45	140	0.0	67	210	0.0	89	280	0.0	89	280	0.0	53	166	
1135	6.4	44	140	2.8	38	119	0.0	41	131	0.0	45	143	0.0	67	214	0.0	89	285	0.0	89	285	0.0	53	168	
1104	6.5	44	140	2.8	38	121	0.0	41	133	0.0	45	145	0.0	67	217	0.0	89	289	0.0	89	289	0.0	53	171	
1073	6.6	43	140	2.9	38	123	0.0	41	135	0.0	45	147	0.0	67	220	0.0	89	294	0.0	89	294	0.0	53	174	
1044	6.7	42	140	2.9	38	125	0.0	41	137	0.0	45	149	0.0	67	224	0.0	89	298	0.0	89	298	0.0	53	176	
1015	6.8	42	140	2.9	38	126	0.0	41	139	0.0	45	152	0.0	67	227	0.0	89	303	0.0	89	303	0.0	53	179	
986	6.9	41	140	3.0	41	141	2.0	41	141	0.0	45	154	0.0	67	230	0.0	89	307	0.0	89	307	0.0	53	181	
957	7.0	40	140	3.0	41	143	2.0	41	143	0.0	45	156	0.0	67	234	0.0	89	312	0.0	89	312	0.0	53	184	
929	7.1	40	140	3.1	42	146	2.1	41	145	0.0	45	158	0.0	67	237	0.0	89	316	0.0	89	316	0.0	53	187	
902	7.2	40	141	3.1	42	148	2.1	41	147	0.0	45	160	0.0	67	240	0.0	89	320	0.0	89	320	0.0	53	189	
874	7.3	40	143	3.1	42	150	2.1	41	149	0.0	45	163	0.0	67	244	0.0	89	325	0.0	89	325	0.0	53	192	
845	7.4	40	146	3.2	42	153	2.2	41	151	0.0	45	165	0.0	67	247	0.0	89	329	0.0	89	329	0.0	53	195	
817	7.5	40	148	3.2	42	155	2.2	41	153	0.0	45	167	0.0	67	250	0.0	89	334	0.0	89	334	0.0	53	197	
787	7.6	40	150	3.3	42	157	2.3	41	155	0.0	45	169	0.0	67	254	0.0	89	338	0.0	89	338	0.0	53	200	
756	7.7	40	152	3.3	42	159	2.3	41	157	0.0	45	172	0.0	67	257	0.0	89	343	0.0	89	343	0.0	53	202	
723	7.8	40	155	3.4	42	162	2.4	41	159	0.0															

DESIGN FACTORS FOR A DESIGN SPEED OF 55 MPH (RURAL) USING E = 8% MAX.

DESIGN VELOCITY = 55	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
	WIDTH= 18 FT				WIDTH=20 FT				WIDTH=22 FT				WIDTH=24 FT				WIDTH=48 FT				WIDTH=72 FT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			1 @ 12'			2 @ 12'			3 @ 12'			16 FT			18 FT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
10000	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
7190	2.0	39	39	0.0	43	43	0.0	47	47	0.0	52	52	0.0	57	57	0.0	62	62	0.0	67	67	0.0	72	72	0.0	77	77	0.0	82	82	0.0	87	87	0.0	92	92	0.0	97	97	0.0	102	102	0.0	107	107	0.0	112	112	0.0	117	117	0.0	122	122	0.0	127	127	0.0	132	132	0.0	137	137	0.0	142	142	0.0	147	147	0.0	152	152	0.0	157	157	0.0	162	162	0.0	167	167	0.0	172	172	0.0	177	177	0.0	182	182	0.0	187	187	0.0	192	192	0.0	197	197	0.0	202	202	0.0	207	207	0.0	212	212	0.0	217	217	0.0	222	222	0.0	227	227	0.0	232	232	0.0	237	237	0.0	242	242	0.0	247	247	0.0	252	252	0.0	257	257	0.0	262	262	0.0	267	267	0.0	272	272	0.0	277	277	0.0	282	282	0.0	287	287	0.0	292	292	0.0	297	297	0.0	302	302	0.0	307	307	0.0	312	312	0.0	317	317	0.0	322	322	0.0	327	327	0.0	332	332	0.0	337	337	0.0	342	342	0.0	347	347	0.0	352	352	0.0	357	357	0.0	362	362	0.0	367	367	0.0	372	372	0.0	377	377	0.0	382	382	0.0	387	387	0.0	392	392	0.0	397	397	0.0	402	402	0.0	407	407	0.0	412	412	0.0	417	417	0.0	422	422	0.0	427	427	0.0	432	432	0.0	437	437	0.0	442	442	0.0	447	447	0.0	452	452	0.0	457	457	0.0	462	462	0.0	467	467	0.0	472	472	0.0	477	477	0.0	482	482	0.0	487	487	0.0	492	492	0.0	497	497	0.0	502	502	0.0	507	507	0.0	512	512	0.0	517	517	0.0	522	522	0.0	527	527	0.0	532	532	0.0	537	537	0.0	542	542	0.0	547	547	0.0	552	552	0.0	557	557	0.0	562	562	0.0	567	567	0.0	572	572	0.0	577	577	0.0	582	582	0.0	587	587	0.0	592	592	0.0	597	597	0.0	602	602	0.0	607	607	0.0	612	612	0.0	617	617	0.0	622	622	0.0	627	627	0.0	632	632	0.0	637	637	0.0	642	642	0.0	647	647	0.0	652	652	0.0	657	657	0.0	662	662	0.0	667	667	0.0	672	672	0.0	677	677	0.0	682	682	0.0	687	687	0.0	692	692	0.0	697	697	0.0	702	702	0.0	707	707	0.0	712	712	0.0	717	717	0.0	722	722	0.0	727	727	0.0	732	732	0.0	737	737	0.0	742	742	0.0	747	747	0.0	752	752	0.0	757	757	0.0	762	762	0.0	767	767	0.0	772	772	0.0	777	777	0.0	782	782	0.0	787	787	0.0	792	792	0.0	797	797	0.0	802	802	0.0	807	807	0.0	812	812	0.0	817	817	0.0	822	822	0.0	827	827	0.0	832	832	0.0	837	837	0.0	842	842	0.0	847	847	0.0	852	852	0.0	857	857	0.0	862	862	0.0	867	867	0.0	872	872	0.0	877	877	0.0	882	882	0.0	887	887	0.0	892	892	0.0	897	897	0.0	902	902	0.0	907	907	0.0	912	912	0.0	917	917	0.0	922	922	0.0	927	927	0.0	932	932	0.0	937	937	0.0	942	942	0.0	947	947	0.0	952	952	0.0	957	957	0.0	962	962	0.0	967	967	0.0	972	972	0.0	977	977	0.0	982	982	0.0	987	987	0.0	992	992	0.0	997	997	0.0	1002	1002	0.0	1007	1007	0.0	1012	1012	0.0	1017	1017	0.0	1022	1022	0.0	1027	1027	0.0	1032	1032	0.0	1037	1037	0.0	1042	1042	0.0	1047	1047	0.0	1052	1052	0.0	1057	1057	0.0	1062	1062	0.0	1067	1067	0.0	1072	1072	0.0	1077	1077	0.0	1082	1082	0.0	1087	1087	0.0	1092	1092	0.0	1097	1097	0.0	1102	1102	0.0	1107	1107	0.0	1112	1112	0.0	1117	1117	0.0	1122	1122	0.0	1127	1127	0.0	1132	1132	0.0	1137	1137	0.0	1142	1142	0.0	1147	1147	0.0	1152	1152	0.0	1157	1157	0.0	1162	1162	0.0	1167	1167	0.0	1172	1172	0.0	1177	1177	0.0	1182	1182	0.0	1187	1187	0.0	1192	1192	0.0	1197	1197	0.0	1202	1202	0.0	1207	1207	0.0	1212	1212	0.0	1217	1217	0.0	1222	1222	0.0	1227	1227	0.0	1232	1232	0.0	1237	1237	0.0	1242	1242	0.0	1247	1247	0.0	1252	1252	0.0	1257	1257	0.0	1262	1262	0.0	1267	1267	0.0	1272	1272	0.0	1277	1277	0.0	1282	1282	0.0	1287	1287	0.0	1292	1292	0.0	1297	1297	0.0	1302	1302	0.0	1307	1307	0.0	1312	1312	0.0	1317	1317	0.0	1322	1322	0.0	1327	1327	0.0	1332	1332	0.0	1337	1337	0.0	1342	1342	0.0	1347	1347	0.0	1352	1352	0.0	1357	1357	0.0	1362	1362	0.0	1367	1367	0.0	1372	1372	0.0	1377	1377	0.0	1382	1382	0.0	1387	1387	0.0	1392	1392	0.0	1397	1397	0.0	1402	1402	0.0	1407	1407	0.0	1412	1412	0.0	1417	1417	0.0	1422	1422	0.0	1427	1427	0.0	1432	1432	0.0	1437	1437	0.0	1442	1442	0.0	1447	1447	0.0	1452	1452	0.0	1457	1457	0.0	1462	1462	0.0	1467	1467	0.0	1472	1472	0.0	1477	1477	0.0	1482	1482	0.0	1487	1487	0.0	1492	1492	0.0	1497	1497	0.0	1502	1502	0.0	1507	1507	0.0	1512	1512	0.0	1517	1517	0.0	1522	1522	0.0	1527	1527	0.0	1532	1532	0.0	1537	1537	0.0	1542	1542	0.0	1547	1547	0.0	1552	1552	0.0	1557	1557	0.0	1562	1562	0.0	1567	1567	0.0	1572	1572	0.0	1577	1577	0.0	1582	1582	0.0	1587	1587	0.0	1592	1592	0.0	1597	1597	0.0	1602	1602	0.0	1607	1607	0.0	1612	1612	0.0	1617	1617	0.0	1622	1622	0.0	1627	1627	0.0	1632	1632	0.0	1637	1637	0.0	1642	1642	0.0	1647	1647	0.0	1652	1652	0.0	1657	1657	0.0	1662	1662	0.0	1667	1667	0.0	1672	1672	0.0	1677	1677	0.0	1682	1682	0.0	1687	1687	0.0	1692	1692	0.0	1697	1697	0.0	1702	1702	0.0	1707	1707	0.0	1712	1712	0.0	1717	1717	0.0	1722	1722	0.0	1727	1727	0.0	1732	1732	0.0	1737	1737	0.0	1742	1742	0.0	1747	1747	0.0	1752	1752	0.0	1757	1757	0.0	1762	1762	0.0	1767	1767	0.0	1772	1772	0.0	1777	1777	0.0	1782	1782	0.0	1787	1787	0.0	1792	1792	0.0	1797	1797	0.0	1802	1802	0.0	1807	1807	0.0	1812	1812	0.0	1817	1817	0.0	1822	1822	0.0	1827	1827	0.0	1832	1832	0.0	1837	1837	0.0	1842	1842	0.0	1847	1847	0.0	1852	1852	0.0	1857	1857	0.0	1862	1862	0.0	1867	1867	0.0	1872	1872	0.0	1877	1877	0.0	1882	1882	0.0	1887	1887	0.0	1892	1892	0.0	1897	1897	0.0	1902	1902	0.0	1907	1907	0.0	1912	1912	0.0	1917	1917	0.0	1922	1922	0.0	1927	1927	0.0	1932	1932	0.0	1937	1937	0.0	1942	1942	0.0	1947	1947	0.0	1952	1952	0.0	1957	1957	0.0	1962	1962	0.0	1967	1967	0.0	1972	1972	0.0	1977	1977	0.0	1982	1982	0.0	1987	1987	0.0	1992	1992	0.0	1997	1997	0.0	2002	2002	0.0	2007	2007	0.0	2012	2012	0.0	2017	2017	0.0	2022	2022	0.0	2027	2027	0.0	2032	2032	0.0	2037	2037	0.0	2042	2042	0.0	2047	2047	0.0	2052	2052	0.0	2057	2057	0.0	2062	2062	0.0	2067	2067	0.0	2072	2072	0.0	2077	2077	0.0	2082	2082	0.0	2087	2087	0.0	2092	2092	0.0	2097	2097	0.0	2102	2102	0.0	2107	2107	0.0	2112	2112	0.0	2117	2117	0.0	2122	2122	0.0	2127	2127	0.0	2132	2132	0.0	2137	2137	0.0	2142	2142	0.0	2147	2147	0.0	2152	2152	0.0	2157	2157	0.0	2162	2162	0.0	2167	2167	0.0	2172	2172	0.0	2177	2177	0.0	2182	2182	0.0	2187	2187	0.0	2192	2192	0.0	2197	2197	0.0	2202	2202	0.0	2207	2207	0.0	2212	2212	0.0	2217	2217	0.0	2222	2222	0.0	2227	2227	0.0	2232	2232	0.0	2237	2237	0.0	2242	2242	0.0	2247	2247	0.0	2252	2252	0.0	2257	2257	0.0	2262	2262	0.0	2267	2267	0.0	2272	2272	0.0	2277	2277	0.0	2282	2282	0.0	2287	2287	0.0	2292	2292	0.0	2297	2297	0.0	2302	2302	0.0	2307	2307	0.0	2312	2312	0.0	2317	2317	0.0	2322	2322	0.0	2327	2327	0.0	2332	2332	0.0	2337	2337	0.0

DESIGN FACTORS FOR A DESIGN SPEED OF 60 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY -60	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)										WIDTH-72 FT						INTERCHANGE RAMPS					
	1 @ 9'		1 @ 10'		1 @ 11'		1 @ 12'		1 @ 12'		2 @ 12'		3 @ 12'		16 FT		18 FT					
	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	CR	LS			
	E(%)	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12000	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
8480	2.0	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
8048	2.1	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
7654	2.2	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
7294	2.3	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
6965	2.4	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
6661	2.5	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
6381	2.6	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
6121	2.7	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
5879	2.8	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
5654	2.9	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
5444	3.0	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
5247	3.1	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
5063	3.2	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
4889	3.3	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
4725	3.4	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
4571	3.5	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
4424	3.6	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
4286	3.7	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
4155	3.8	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
4030	3.9	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3911	4.0	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3798	4.1	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3690	4.2	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3587	4.3	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3488	4.4	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3394	4.5	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3303	4.6	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3216	4.7	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3133	4.8	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
3053	4.9	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
2975	5.0	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
2901	5.1	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
2866	5.2	40	0.0	45	4.0	49	0.0	54	5.0	58	0.0	63	6.0	67	7.0	72	7.0	77	8.0			
2865	5.2	70	180	2.3	45	116	0.0	49	128	0.0	54	139	0.0	80	208	0.0	63	164	67	174		
2829	5.2	70	180	2.4	45	116	0.0	49	128	0.0	54	139	0.0	80	208	0.0	63	164	67	174		
2759	5.3	68	180	2.4	45	118	0.0	49	130	0.0	54	142	0.0	80	212	0.0	63	167	67	177		
2692	5.4	67	180	2.4	45	120	0.0	49	132	0.0	54	144	0.0	80	216	0.0	63	170	67	180		
2627	5.5	66	180	2.4	45	123	0.0	49	135	0.0	54	147	0.0	80	220	0.0	63	173	67	184		
2565	5.6	65	180	2.4	45	125	0.0	49	137	0.0	54	150	0.0	80	224	0.0	63	176	67	187		
2504	5.7	64	180	2.4	45	127	0.0	49	140	0.0	54	152	0.0	80	228	0.0	63	179	67	190		
2445	5.8	63	180	2.5	45	129	0.0	49	142	0.0	54	155	0.0	80	232	0.0	63	182	67	194		
2387	5.9	62	180	2.5	45	132	0.0	49	145	0.0	54	158	0.0	80	236	0.0	63	186	67	197		
2332	6.0	60	180	2.5	45	134	0.0	49	147	0.0	54	160	0.0	80	240	0.0	63	189	67	200		
2277	6.1	60	180	2.5	45	136	0.0	49	150	0.0	54	163	0.0	80	244	0.0	63	192	67	204		
2225	6.2	59	180	2.5	45	138	0.0	49	152	0.0	54	166	0.0	80	248	0.0	63	195	67	207		
2173	6.3	58	180	2.6	45	140	0.0	49	154	0.0	54	168	0.0	80	252	0.0	63	198	67	210		
2122	6.4	57	180	2.6	45	143	0.0	49	157	0.0	54	171	0.0	80	256	0.0	63	201	67	214		
2072	6.5	56	180	2.6	45	145	0.0	49	159	0.0	54	174	0.0	80	260	0.0	63	204	67	217		
2022	6.6	55	180	2.6	45	147	0.0	49	162	0.0	54	176	0.0	80	264	0.0	63	208	67	220		
1974	6.7	54	180	2.6	45	149	0.0	49	164	0.0	54	179	0.0	80	268	0.0	63	211	67	224		
1925	6.8	53	180	2.7	45	152	0.0	49	167	0.0	54	182	0.0	80	272	0.0	63	214	67	227		
1877	6.9	53	180	2.7	45	154	0.0	49	169	0.0	54	184	0.0	80	276	0.0	63	217	67	230		
1830	7.0	52	180	2.7	45	156	0.0	49	172	0.0	54	187	0.0	80	280	0.0	63	220	67	234		
1782	7.1	51	180	2.7	45	158	0.0	49	174	0.0	54	190	0.0	80	284	0.0	63	223	67	237		
1735	7.2	50	180	2.8	45	160	0.0	49	176	0.0	54	192	0.0	80	288	0.0	63	226	67	240		
1687	7.3	50	180	2.8	45	163	0.0	49	179	0.0	54	195	0.0	80	292	0.0	63	230	67	244		
1638	7.4	49	180	2.8	45	165	0.0	49	181	0.0	54	198	0.0	80	296	0.0	63	233	67	247		
1588	7.5	48	180	2.9	45	167	0.0	49	184	0.0	54	200	0.0	80	300	0.0	63	236	67	250		
1537	7.6	48	180	2.9	45	169	0.0	49	186	0.0	54	203	0.0	80	304	0.0	63	239	67	254		
1482	7.7	47	180	2.9	45	172	0.0	49	189	0.0	54	206	0.0	80	308	0.0	63	242	67	257		
1422	7.8	47	182	3.0	49	191	2.0	49	191	0.0	54	208	0.0	80	312	0.0	63	245	67	260		
1350	7.9	47	185	3.0	49	194	2.0	49	194	0.0	54	211	0.0	80	316	0.0	63	248	67	264		
1204	8.0	48	189	3.2	50	198	2.2	49	196	0.0	54	214	0.0	80	320	0.0	63	251	67	267		

NOTE: CR, LS & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.

TRANSITION CURVES - RURAL
60 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

DESIGN FACTORS FOR A DESIGN SPEED OF 65 MPH (RURAL) USING E = 8% MAX.

DESIGN VELOCITY =65	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS													
	WIDTH= 18 FT				WIDTH=20 FT				WIDTH=22 FT				WIDTH=24 FT				WIDTH=48 FT		WIDTH=72 FT							
	1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			1 @ 12'			2 @ 12'			3 @ 12'			16 FT		18 FT		
	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	CR	LS
14000	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9566	2.0	42	40	0.0	47	47	0.0	52	52	0.0	56	56	0.0	84	84	0.0	112	112	0.0	166	166	0.0	232	232	0.0	316
9083	2.1	42	44	0.0	47	49	0.0	52	54	0.0	56	59	0.0	84	88	0.0	112	118	0.0	166	172	0.0	232	240	0.0	316
8643	2.2	42	47	0.0	47	52	0.0	52	57	0.0	56	62	0.0	84	93	0.0	112	123	0.0	166	172	0.0	232	240	0.0	316
8242	2.3	42	49	0.0	47	54	0.0	52	59	0.0	56	65	0.0	84	97	0.0	112	129	0.0	166	176	0.0	232	240	0.0	316
7873	2.4	42	51	0.0	47	56	0.0	52	62	0.0	56	67	0.0	84	101	0.0	112	134	0.0	166	179	0.0	232	240	0.0	316
7534	2.5	42	53	0.0	47	59	0.0	52	64	0.0	56	70	0.0	84	105	0.0	112	140	0.0	166	182	0.0	232	240	0.0	316
7221	2.6	42	55	0.0	47	61	0.0	52	67	0.0	56	73	0.0	84	109	0.0	112	146	0.0	166	185	0.0	232	240	0.0	316
6931	2.7	42	57	0.0	47	63	0.0	52	70	0.0	56	76	0.0	84	114	0.0	112	151	0.0	166	189	0.0	232	240	0.0	316
6662	2.8	42	59	0.0	47	66	0.0	52	72	0.0	56	79	0.0	84	118	0.0	112	157	0.0	166	192	0.0	232	240	0.0	316
6411	2.9	42	61	0.0	47	68	0.0	52	75	0.0	56	81	0.0	84	122	0.0	112	162	0.0	166	195	0.0	232	240	0.0	316
6176	3.0	42	63	0.0	47	70	0.0	52	77	0.0	56	84	0.0	84	126	0.0	112	168	0.0	166	198	0.0	232	240	0.0	316
5957	3.1	42	65	0.0	47	73	0.0	52	80	0.0	56	87	0.0	84	130	0.0	112	174	0.0	166	202	0.0	232	240	0.0	316
5751	3.2	42	67	0.0	47	75	0.0	52	82	0.0	56	90	0.0	84	134	0.0	112	179	0.0	166	205	0.0	232	240	0.0	316
5557	3.3	42	70	0.0	47	77	0.0	52	85	0.0	56	93	0.0	84	139	0.0	112	185	0.0	166	208	0.0	232	240	0.0	316
5375	3.4	42	72	0.0	47	80	0.0	52	87	0.0	56	95	0.0	84	143	0.0	112	190	0.0	166	211	0.0	232	240	0.0	316
5203	3.5	42	74	0.0	47	82	0.0	52	90	0.0	56	98	0.0	84	147	0.0	112	196	0.0	166	215	0.0	232	240	0.0	316
5040	3.6	42	76	0.0	47	84	0.0	52	93	0.0	56	101	0.0	84	151	0.0	112	201	0.0	166	218	0.0	232	240	0.0	316
4886	3.7	42	78	0.0	47	87	0.0	52	95	0.0	56	104	0.0	84	155	0.0	112	207	0.0	166	221	0.0	232	240	0.0	316
4740	3.8	42	80	0.0	47	89	0.0	52	98	0.0	56	107	0.0	84	160	0.0	112	213	0.0	166	225	0.0	232	240	0.0	316
4601	3.9	42	82	0.0	47	91	0.0	52	100	0.0	56	109	0.0	84	164	0.0	112	218	0.0	166	228	0.0	232	240	0.0	316
4469	4.0	42	84	0.0	47	94	0.0	52	103	0.0	56	112	0.0	84	168	0.0	112	224	0.0	166	231	0.0	232	240	0.0	316
4344	4.1	42	86	0.0	47	96	0.0	52	105	0.0	56	115	0.0	84	172	0.0	112	229	0.0	166	234	0.0	232	240	0.0	316
4224	4.2	42	88	0.0	47	98	0.0	52	108	0.0	56	118	0.0	84	176	0.0	112	235	0.0	166	238	0.0	232	240	0.0	316
4109	4.3	42	90	0.0	47	100	0.0	52	110	0.0	56	120	0.0	84	180	0.0	112	240	0.0	166	241	0.0	232	240	0.0	316
4000	4.4	42	93	0.0	47	103	0.0	52	113	0.0	56	123	0.0	84	185	0.0	112	246	0.0	166	244	0.0	232	240	0.0	316
3896	4.5	42	95	0.0	47	105	0.0	52	116	0.0	56	126	0.0	84	189	0.0	112	252	0.0	166	247	0.0	232	240	0.0	316
3795	4.6	42	97	0.0	47	107	0.0	52	118	0.0	56	129	0.0	84	193	0.0	112	257	0.0	166	251	0.0	232	240	0.0	316
3699	4.7	42	99	0.0	47	110	0.0	52	121	0.0	56	132	0.0	84	197	0.0	112	263	0.0	166	254	0.0	232	240	0.0	316
3607	4.8	42	101	0.0	47	112	0.0	52	123	0.0	56	134	0.0	84	201	0.0	112	268	0.0	166	257	0.0	232	240	0.0	316
3518	4.9	42	103	0.0	47	114	0.0	52	126	0.0	56	137	0.0	84	206	0.0	112	274	0.0	166	260	0.0	232	240	0.0	316
3433	5.0	42	105	0.0	47	117	0.0	52	128	0.0	56	140	0.0	84	210	0.0	112	280	0.0	166	264	0.0	232	240	0.0	316
3351	5.1	42	107	0.0	47	119	0.0	52	131	0.0	56	143	0.0	84	214	0.0	112	285	0.0	166	267	0.0	232	240	0.0	316
3272	5.2	42	109	0.0	47	121	0.0	52	134	0.0	56	146	0.0	84	218	0.0	112	291	0.0	166	270	0.0	232	240	0.0	316
3196	5.3	42	111	0.0	47	124	0.0	52	136	0.0	56	148	0.0	84	222	0.0	112	296	0.0	166	274	0.0	232	240	0.0	316
3122	5.4	42	114	0.0	47	126	0.0	52	139	0.0	56	151	0.0	84	227	0.0	112	302	0.0	166	277	0.0	232	240	0.0	316
3051	5.5	42	116	0.0	47	128	0.0	52	141	0.0	56	154	0.0	84	231	0.0	112	307	0.0	166	280	0.0	232	240	0.0	316
2982	5.6	42	118	0.0	47	131	0.0	52	144	0.0	56	157	0.0	84	235	0.0	112	313	0.0	166	283	0.0	232	240	0.0	316
2916	5.7	42	120	0.0	47	133	0.0	52	146	0.0	56	160	0.0	84	239	0.0	112	319	0.0	166	287	0.0	232	240	0.0	316
2866	5.8	42	122	0.0	47	135	0.0	52	149	0.0	56	162	0.0	84	243	0.0	112	324	0.0	166	290	0.0	232	240	0.0	316
2865	5.8	69	200	2.4	47	135	0.0	52	149	0.0	56	162	0.0	84	243	0.0	112	324	0.0	166	290	0.0	232	240	0.0	316
2852	5.8	69	200	2.4	47	135	0.0	52	149	0.0	56	162	0.0	84	243	0.0	112	324	0.0	166	290	0.0	232	240	0.0	316
2789	5.9	68	200	2.5	47	138	0.0	52	151	0.0	56	165	0.0	84	247	0.0	112	330	0.0	166	293	0.0	232	240	0.0	316
2729	6.0	67	200	2.5	47	140	0.0	52	154	0.0	56	168	0.0	84	252	0.0	112	335	0.0	166	296	0.0	232	240	0.0	316
2670	6.1	66	200	2.5	47	142	0.0	52	157	0.0	56	171	0.0	84	256	0.0	112	341	0.0	166	299	0.0	232	240	0.0	316
2613	6.2	65	200	2.5	47	145	0.0	52	159	0.0	56	174	0.0	84	260	0.0	112	347	0.0	166	303	0.0	232	240	0.0	316
2558	6.3	64	200	2.5	47	147	0.0	52	162	0.0	56	176	0.0	84	264	0.0	112	352	0.0	166	306	0.0	232	240	0.0	316
2504	6.4	63	200	2.5	47	149	0.0	52	164	0.0	56	179	0.0	84	268	0.0	112	358	0.0	166	309	0.0	232	240	0.0	316
2451	6.5	62	200	2.6	47	152	0.0	52	167	0.0	56	182	0.0	84	273	0.0	112	363	0.0	166	313	0.0	232	240	0.0	316
2398	6.6	61	200	2.6	47	154	0.0	52	169	0.0	56	185	0.0	84	277	0.0	112	369	0.0	166	316	0.0	232	240	0.0	316
2346	6.7	60	200	2.6	47	156	0.0	52	172	0.0	56	187	0.0	84	281	0.0	112	374	0.0	166	319	0.0	232	240	0.0	316
2294	6.8	59	200	2.6	47	159	0.0	52	174	0.0	56	190	0.0	84	285	0.0	112	380	0.0	166	323	0.0	232	240	0.0	316
2242	6.9	58	200	2.6	47	161	0.0	52	177	0.0	56	193	0.0	84	289	0.0	112	386	0.0	166	326	0.0	232	240	0.0	316
2191	7.0	58	200	2.7	47	163	0.0	52	180	0.0	56	196	0.0	84	294	0.0	112	391	0.0	166	329	0.0	232	240	0.0	316
2139	7.1	57	200	2.7	47	166	0.0	52	182	0.0	56	199	0.0	84	298	0.0	112	397	0.0	166	332	0.0	232	240	0.0	316
2087	7.2	56	200</																							

DESIGN FACTORS FOR A DESIGN SPEED OF 70 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY -70	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS																						
	WIDTH-18 FT			WIDTH-20 FT			WIDTH-22 FT			WIDTH-24 FT			WIDTH-48 FT			WIDTH-72 FT			WIDTH-72 FT			18 FT													
	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS
12000	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10731	2.0	45	0	50	0.0	55	55	0.0	60	60	0.0	60	60	0.0	90	90	0.0	90	90	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
10194	2.1	45	48	0	50	53	0	55	58	0	60	63	0	90	95	0	90	95	0	120	126	0	120	126	0	120	126	0	120	126	0	120	126	0	
9706	2.2	45	50	0	50	55	0	55	61	0	60	66	0	90	94	0	90	94	0	120	132	0	120	132	0	120	132	0	120	132	0	120	132	0	
9260	2.3	45	52	0	50	58	0	55	64	0	60	69	0	90	100	0	90	104	0	120	138	0	120	138	0	120	138	0	120	138	0	120	138	0	
8851	2.4	45	54	0	50	60	0	55	66	0	60	72	0	90	108	0	90	108	0	120	144	0	120	144	0	120	144	0	120	144	0	120	144	0	
8474	2.5	45	57	0	50	63	0	55	69	0	60	75	0	90	113	0	90	113	0	120	150	0	120	150	0	120	150	0	120	150	0	120	150	0	
8127	2.6	45	59	0	50	65	0	55	72	0	60	78	0	90	117	0	90	117	0	120	156	0	120	156	0	120	156	0	120	156	0	120	156	0	
7805	2.7	45	61	0	50	68	0	55	75	0	60	81	0	90	122	0	90	122	0	120	162	0	120	162	0	120	162	0	120	162	0	120	162	0	
7506	2.8	45	63	0	50	70	0	55	77	0	60	84	0	90	126	0	90	126	0	120	168	0	120	168	0	120	168	0	120	168	0	120	168	0	
7227	2.9	45	66	0	50	73	0	55	80	0	60	87	0	90	131	0	90	131	0	120	174	0	120	174	0	120	174	0	120	174	0	120	174	0	
6967	3.0	45	68	0	50	75	0	55	83	0	60	90	0	90	135	0	90	135	0	120	180	0	120	180	0	120	180	0	120	180	0	120	180	0	
6724	3.1	45	70	0	50	78	0	55	86	0	60	93	0	90	140	0	90	140	0	120	186	0	120	186	0	120	186	0	120	186	0	120	186	0	
6495	3.2	45	72	0	50	80	0	55	88	0	60	96	0	90	144	0	90	144	0	120	192	0	120	192	0	120	192	0	120	192	0	120	192	0	
6281	3.3	45	75	0	50	83	0	55	91	0	60	99	0	90	149	0	90	149	0	120	198	0	120	198	0	120	198	0	120	198	0	120	198	0	
6079	3.4	45	77	0	50	85	0	55	94	0	60	102	0	90	153	0	90	153	0	120	204	0	120	204	0	120	204	0	120	204	0	120	204	0	
5888	3.5	45	79	0	50	88	0	55	97	0	60	105	0	90	158	0	90	158	0	120	210	0	120	210	0	120	210	0	120	210	0	120	210	0	
5708	3.6	45	81	0	50	90	0	55	99	0	60	108	0	90	162	0	90	162	0	120	216	0	120	216	0	120	216	0	120	216	0	120	216	0	
5537	3.7	45	84	0	50	93	0	55	102	0	60	111	0	90	167	0	90	167	0	120	222	0	120	222	0	120	222	0	120	222	0	120	222	0	
5376	3.8	45	86	0	50	95	0	55	105	0	60	114	0	90	171	0	90	171	0	120	228	0	120	228	0	120	228	0	120	228	0	120	228	0	
5222	3.9	45	88	0	50	98	0	55	108	0	60	117	0	90	176	0	90	176	0	120	234	0	120	234	0	120	234	0	120	234	0	120	234	0	
5076	4.0	45	90	0	50	100	0	55	110	0	60	120	0	90	180	0	90	180	0	120	240	0	120	240	0	120	240	0	120	240	0	120	240	0	
4937	4.1	45	93	0	50	103	0	55	113	0	60	123	0	90	185	0	90	185	0	120	246	0	120	246	0	120	246	0	120	246	0	120	246	0	
4805	4.2	45	95	0	50	105	0	55	116	0	60	126	0	90	189	0	90	189	0	120	252	0	120	252	0	120	252	0	120	252	0	120	252	0	
4679	4.3	45	97	0	50	108	0	55	119	0	60	129	0	90	194	0	90	194	0	120	258	0	120	258	0	120	258	0	120	258	0	120	258	0	
4558	4.4	45	99	0	50	110	0	55	121	0	60	132	0	90	198	0	90	198	0	120	264	0	120	264	0	120	264	0	120	264	0	120	264	0	
4443	4.5	45	102	0	50	113	0	55	124	0	60	135	0	90	203	0	90	203	0	120	270	0	120	270	0	120	270	0	120	270	0	120	270	0	
4332	4.6	45	104	0	50	115	0	55	127	0	60	138	0	90	207	0	90	207	0	120	276	0	120	276	0	120	276	0	120	276	0	120	276	0	
4226	4.7	45	106	0	50	118	0	55	130	0	60	141	0	90	212	0	90	212	0	120	282	0	120	282	0	120	282	0	120	282	0	120	282	0	
4125	4.8	45	108	0	50	120	0	55	132	0	60	144	0	90	216	0	90	216	0	120	288	0	120	288	0	120	288	0	120	288	0	120	288	0	
4027	4.9	45	111	0	50	123	0	55	135	0	60	147	0	90	221	0	90	221	0	120	294	0	120	294	0	120	294	0	120	294	0	120	294	0	
3933	5.0	45	113	0	50	125	0	55	138	0	60	150	0	90	225	0	90	225	0	120	300	0	120	300	0	120	300	0	120	300	0	120	300	0	
3843	5.1	45	115	0	50	128	0	55	141	0	60	153	0	90	230	0	90	230	0	120	306	0	120	306	0	120	306	0	120	306	0	120	306	0	
3756	5.2	45	117	0	50	130	0	55	143	0	60	156	0	90	234	0	90	234	0	120	312	0	120	312	0	120	312	0	120	312	0	120	312	0	
3673	5.3	45	120	0	50	133	0	55	146	0	60	159	0	90	239	0	90	239	0	120	318	0	120	318	0	120	318	0	120	318	0	120	318	0	
3592	5.4	45	122	0	50	135	0	55	149	0	60	162	0	90	243	0	90	243	0	120	324	0	120	324	0	120	324	0	120	324	0	120	324	0	
3514	5.5	45	124	0	50	138	0	55	152	0	60	165	0	90	248	0	90	248	0	120	330	0	120	330	0	120	330	0	120	330	0	120	330	0	
3439	5.6	45	126	0	50	140	0	55	154	0	60	168	0	90	252	0	90	252	0	120	336	0	120	336	0	120	336	0	120	336	0	120	336	0	
3366	5.7	45	129	0	50	143	0	55	157	0	60	171	0	90	257	0	90	257	0	120	342	0	120	342	0	120	342	0	120	342	0	120	342	0	
3296	5.8	45	131	0	50	145	0	55	160	0	60	174	0	90	261	0	90	261	0	120	348	0	120	348	0	120	348	0	120	348	0	120	348	0	
3228	5.9	45	133	0	50	148	0	55	163	0	60	177	0	90	266	0	90	266	0	120	354	0	120	354	0	120	354	0	120	354	0	120	354	0	
3163	6.0	45	135	0	50	150	0	55	165	0	60	180	0	90	270	0	90	270	0	120	360	0	120	360	0	120	360	0	120	360	0	120	360	0	
3099	6.1	45	138	0	50	153	0	55	168	0	60	183	0	90	275	0	90	275	0	120	366	0	120	366	0	120	366	0	120	366	0	120	366	0	
3037	6.2	45	140	0	50	155	0	55	171	0	60	186	0	90	279	0	90	279	0	120	372	0	120	372	0	120	372	0	120	372	0	120	372	0	
2977	6.3	45	142	0	50	158	0	55	174	0	60	189	0	90	284	0	90	284	0	120	378	0	120	378	0	120	378	0	120	378	0	120	378	0	
2919	6.4	45	144	0	50	160	0	55	176	0	60	192	0	90	288	0	90	288	0	120	384	0	120	384	0	120	384	0	120	384	0	120	384	0	
2866</																																			